如果時間是穿戴且折疊的　天然纖維與雷射染合作展

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未來工藝的社群想像：如果時間是穿戴且折疊的——天然纖維與雷射染合作展

「如果時間是穿戴且折疊的」——天然纖維與雷射染跨域合作創新展於2020年1月3日開展，以雷射染計畫為載體，將科技和數位製造帶入工藝社群的實驗展覽，透過不同領域的結合與應用，重新建構天然纖維與染色的多元可能性。

本次展覽不只是一個跨域藝術計劃，更是一個獨立創作計劃受益於社群合作的展現。啟發自傳統的氰版顯影，雷射染是一項結合數位製造、程式碼藝術、顯影工藝在天然纖維上留下永久的具有階度的藍色影像的實驗織品計劃。此次工藝中心以實驗展形式結合雷射染和天然纖維染色工藝合作，展品包含數件印花裝置、雷射染意象裝置、雷射染計劃結合天然染色、農廢材料如鳳梨纖維、構樹皮等實驗性嘗試的紀錄；展覽實驗內容涵括氰版顯影與植物染料的互補性，程式碼藝術在染色工藝中的展現，藉由介紹雷射染計畫所參與的諸多國際交流和計畫遊牧的軌跡，描繪未來工藝和其他社群合作，即將形成的一個介面網絡想像。

本次展品中有數幅作品在雷射染印花上疊染天然染料，利用氰版顯影和植物染料皆適用於天然纖維之特性，先使氰版成品在鹼液中褪色、再找出能與之疊染之植物染料進行覆染。經過數次覆染後，原本的印花經由與染液的酸鹼屬性的交互作用而產生色澤異變和邊界模糊，一如跨領域合作中時常產生的不可預測之結果。

因應連結國際社群主題，策展單位邀請了雷射染計畫曾經參與過的國際社群：來自紐約電子織品社群e-Textile Spring Break的織品藝術家維多利亞（Victoria Manganiello）和由日籍藝術家的大山龍（Ryu Oyama）和韓籍藝術家的金伊爾達（Ilda Kim）組成的團體ISC舉辦跨領域講座和工作坊並開放民眾參與。維多利亞的講座以「改變工藝社區」為題，探討互聯聯網時代的工藝社群變遷和女性賦權趨勢；她在工作坊中介紹以數據資料作為手工編織的概念依據，帶領參與者將二進制代碼轉換為編織符碼。雙人藝術團體ISC也帶來表演形式的工作坊，結合演說和米粥服務探討實質和抽象、有形與無形及可見和不可見的相反極端，並以不同視角重新定義「邊界」的含義，就跨社群邊界為題向參與者發起討論。

國立臺灣工藝研究發展中心主任
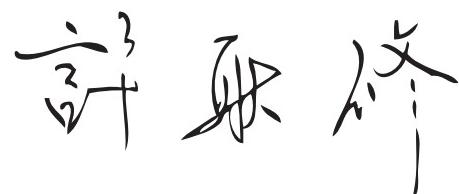
Preface-#1

A Vision For The Future Crafts Communities

"If Time Was Wearable and Foldable"- The collaborative exhibition involving natural fibers and laser dye, not only is a transdisciplinary art project, but also an independent creative project that benefits from community collaboration. Inspired by the traditional cyanotype photography process, Laser Dye is an experimental textile project that combines digital fabrication, code art and alternative photography process to create permanent images of various shades of cyan on natural fibers. The artworks from the exhibition that resulted from this collaboration with the National Taiwan Craftsmanship Research Institution included several printed textile installations, live printing installations inthe Laser Dye Project, prototypes processed with cyanotype and natural dyes, and documentation works from experimenting with agricultural waste materials such as pineapple fibers, and paper mulberry. The content of the experimental works indicates the complementarity between the Laser Dye Project and the natural dyes, and the expression of code art in the dyeing craftsmanship. Furthermore, by introducing international exchanges and nomadic projects involved in the Laser Dye Project over years, and depicting the future of craftsmanship and cooperation with other communities, an imaginary interface network is about to be formed.

Several pieces in this exhibition are dyed repeatedly with natural dyes and cyanotype. Firstly, the finished cyanotype textile fades in the alkaline solution and then its dyed again with suitable natural dyes. After several cycles of this dyeing sequences, a creative toning result is built. It produces variability in colors and blurry borders between colors, as like the interaction in-between transdisciplinary projects. unpredictable result is usually expected.

In response to the theme of connecting the international communities, the curator invited several artists from the international communities that the Laser Dye Project has participated in; Victoria Manganiello from the e-Textile Spring Break community in New York, ISC consists of Ryu Oyama and Ilda Kim from Japan and South Korea. Lecture from Victoria Manganiello "Changing Craft Communities" discusses the women connected by crafts skills in internet era and the empowerment comes with it . She introduces data as a conceptual basis as weaving structures, the binary code is converted to cloth weaving in her workshop. ISC also brought performance-based workshop. They combined speech and rice porridge service to explore the opposite extremes of substance and abstraction, tangible and intangible, and impenetrable and impenetrable, and redefined them with different views "Boundary" means initiating discussions with participants on the topic of cross-community boundaries.

Derector of National Taiwan Craft Research and Development Institute

序-#2

由無機到有機的工藝社群擴大

黑客（hacking）原指對舊系統進行非法（電腦軟體或硬體上的）改造，原始意義是指用一種聰明的方式進入某種受管制的系統並進行特定程度的改造，且不造成巨大的傷害。在本次展覽裡我們以一個染色黑客（dyeing　hacking）的創意計劃為主軸，展示了以DIY雷射投影機曝光的無機氰版顯影工藝與有機的天然染色工藝混合，創造工藝社群和開源科學、DIY運動、時尚和程式碼藝術等文化間的通訊協定介面，透過本次展覽創造一種有益駭入。

展覽中試圖透過雷射染計劃的遊牧足跡，向工藝社群描述一種全球化的網路。網路普及化不僅促進了資本式的動機，也促進了全世界藝術的心智交流。展覽試圖以雷射染計劃為媒體，以「物的傳記」視角，介紹由藝術家、業餘自造者自治的「營」為社群經營形式，以及這些散居的社群所形成的一種去中心化的網絡，為個體的創意計劃提供更多資源。展覽亦邀請了雷射染計劃曾參與的國際社群：三位藝術家於開幕日帶領工作坊和講座，分享這些社群的現況與他們自身對「無邊界的營」的詮釋。

以奈米的尺度進入到雷射氰版顯影的化學過程裡，我們看到從草酸鐵銨和鐵氰化鉀結合後而分離出的草酸鐵鉀結晶。光子在二極體腔體內的鏡子間經過無限反射而激發，並經由意識的指揮降落在預塗佈了感光藥劑的纖維上，產生出這些藍色分子和三價鐵離子，再和天然染材中的單寧酸結合。我們發明了攝影技術然後透過回憶來操作第四維，如同我們的影子降落在別人的回憶裡。約翰·赫歇爾最初發現氰版顯影的動機並不是為了找尋更好的印刷術，而是單純為了驗證自己的另一項研究中而得到的意外，他的業餘好奇心和宇宙自然一般的同調和諧。現在我們把雷射、顯影工藝、天然植物染色看似隨機的放在一起，不確定性和好奇心使我們永遠存活著。在這裏，我們將印製我們的視野。

策展人 施 惟 捷

Preface-#2

The expansion of the community via organic and inorganic

Hacking originally refers to the illegal (computer software or hardware) transformation of the old system, the original meaning refers to a smart way to enter a regulated system and carry out a certain degree of transformation, and does not cause huge damage. We want to share the results of mixing the inorganic alternative photography process exposure with a DIY laser projector, with the organic natural dyeing under the theme of "dyeing hacking", to suggest a beneficial hack in order to establish an interface protocol between the craftsmanship community and cultures such as open science, DIY movement, fashion and code art.

To the audience of the craftsmanship community, this exhibition attempts to introduce a "global tribal network" through the nomadic footprint of the Laser Dye Project and the communities it participated. Not only the capital purposes are benefited by the internet, but also the artistic minds world-widely. The exhibition tried to introduce an international network composed with independent "camps", which are self-organized artists and amateur makers, scientists, through a biography perspective of the Laser Dye Project. This distributed network has began to provide resources to creative individual projects. Three artists from the communities which Laser Dye Projects has participated with, are invited to share workshops and lectures on the opening day to introduce the current status of these communities and their interpretation to the theme: "the borderless camps".

Entering into the chemical process of Laser Dye Project at the nanoscale, the crystal of potassium ferric oxalate is filtered out from the mixture of ferric ammonium oxalate and potassium ferricyanide. The photons are excited by infinite reflection in the cavity of the laser diode, and landed on the fiber pre-coated with the photosensitizer through the command of consciousness, producing these blue molecules. We invented photography and manipulated the fourth dimension through memories, just as our shadows landed in the memories of others. John Herschel' s discovery of cyanotype was not to find a better typography, but only to verify an accident in another study of his own. The curiosity of his amateur is in harmony with the nature of the universe. Now we put the laser, development process, natural dyeing together experimentally, as the same as the indeterminacy and the curiosity keep us alive forever. Hereby we will have our vision printed.

Curator Shih Wei-Chieh
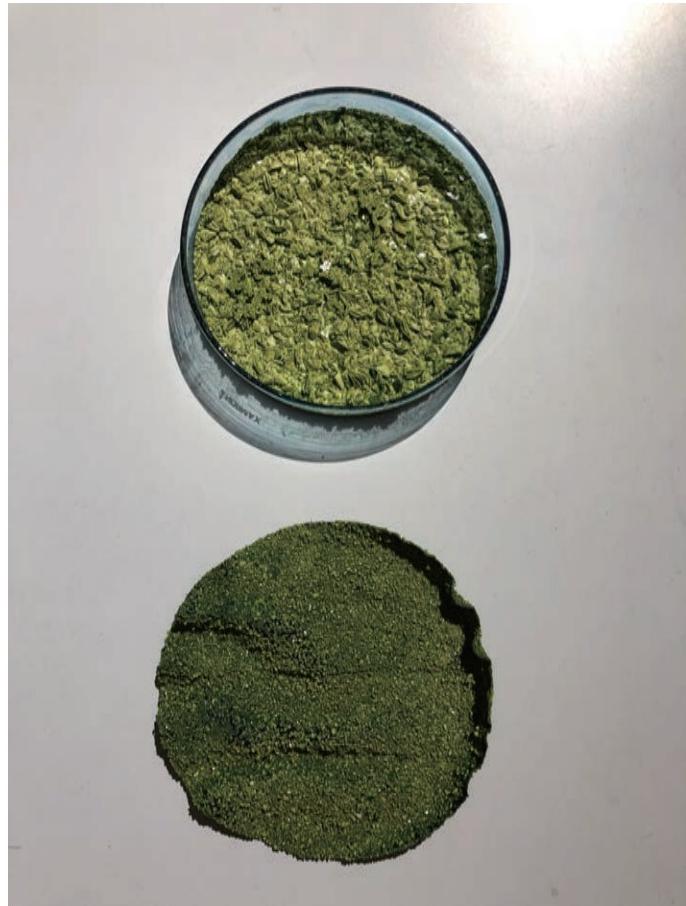
穿越時間的藍

The Blue Dye That Travels Across Time

創造雷射染其中一個靈感來自於著名的「雙縫實驗」：當一個光子以機率態同時穿越了兩個狹縫，自己和自己產生了相干涉，在狹縫背後的屏幕上留下了干涉條紋；好似一顆石頭被投入池塘裡卻形成兩股漣漪。我們理解了在微觀世界中事物可以同時存在於兩地並且互相關聯，時間是非線性的，那麼將不同的時空歷史在腦海中做非線性平行排列，好像也就沒有那麼的無法理解了。

One of the inspirations for the creation of Laser Dye Project came from the famous double slit experiment in physics: when a photon passed through the slit in a probabilistic state and interfered with itself, it left interference fringes on the screen behind the slit, just like a stone thrown into the pond formed two ripples. We understand that in the microcosmic world, things can exist in two places at the same time and are related to each other. Time is non-linear. Then it is not that incomprehensible to rearrange different time and space in the mind historically in a non-linear parallel arrangement.

必須在舊的事物中尋找新的事物

「我們回到過去,而屬於那個過去的現在,也就是仍然擁有所有可能性的現在,行動的所有後果仍然未知」。第一個提出「媒體考古學」的人,理論學家西格弗里·德齊林斯基(Siegfried Zielinski)認為,與其在新事物中尋求舊事物,我們必須在舊事物中探求新事物。

在1839年和1842年之間,氰版的發明者,英國人約翰·赫歇爾對銀鹽,金屬和植物的光敏性進行了數百次單獨的實驗,包括對亞鐵氰化鉀的研究。 阿爾弗雷德·史密(Alfred Smee)博士慷慨地與赫歇爾分享產生了精製的亞鐵氰化鉀。他們兩個一起繼續進行了化學反應和光反應的變化實驗。最後發明了這個經典的顯影技術,由檸檬酸鐵銨和鐵氰化鉀兩個配方組成的氰版顯影(Cyanotype),或稱藍曬法,因為顯影過程須經過太陽照射,最終在紙或織品等基底上製造永久的藍色影像,而且配方中含有「氰」成份而得名。

史上最早的氰版圖案大概是安娜·阿特金斯(Anna Atkins,1799–1871年)所製作的一系列藻類、蕨類、羽毛和水草等以植物學為主的作品集,她的名字和氰版顯影之間幾乎可以劃上等號。她的植物學家父親和赫歇爾是朋友,他們的住所在英格蘭肯特郡只相距30英里,雖然沒有直接的證據顯示安娜向赫歇爾習得氰版的使用方式,但極有可能是這樣的關係使她很早便開始使用氰版來紀錄拷貝植物的紋理,她將藻類植物標本壓在可感光的氰版紙上,出版了《Photographs of British Algae: Cyanotype Impressions》她也因此被視為人類史上的第一位攝影師。

同樣的技術被不同的立場支配,1884年在好望角的川斯瓦共和國(現南非共和國)的一個偏僻牧場上,發現了世界上規模最大的維瓦特斯蘭金礦。來自金礦的利潤和稅收使川斯瓦共和國的經濟得到飛速發展,同時也加劇了以荷裔人口為主的川斯瓦共和國與殖民地主英國的摩擦。三十年之後,第二次波爾戰爭爆發,安娜與赫歇爾的氰版顯影曾在第二年的戰爭中被英軍在梅富根的守城一役中被使用來印製郵票和貨幣,當時的守軍將領巴登·包威爾(Baden-Powell)命令攝影師E.JRoss設計了五版一英磅的氰版紙幣,每一版印製一百份。雖然這些貨幣從未進入到真正的貨幣循環之中,大多數人只將之做為古玩收藏。郵票的設計有兩版,都以梅富根戰役為主題,巴登·包威爾的肖像為圖像。氰版顯影工藝開啟了人類複製影像的序幕,並在20世紀初達到頂峰,然後在銀鹽工藝和之後柯達底片工業的興起下大幅度的退出了舞台,只剩下建築使用的藍圖仍大量依賴氰版顯影製造。

在1920-1950年間氰版技術都沒有被大量運用,且充其量也只是拷貝技術的代名詞,一直到了1960年左右,一些當代攝影師為了 打破底片攝影所帶來的直接性,開始使用非傳統攝影材料來製作攝影,他們開始反對使用柯達的底片產品做直接攝影,並提倡藉 由自行塗佈氰版顯影液於紙張上來製作相紙,至此氰版才成為藝術攝影的一部份。

由於氰版材料的簡易調配過程和低廉的價格，但圖像品質卻不是最好的，而且面對氰版顯影工藝需要過長時間曝光，顯影液的保存性不足，和在洗滌過程中容易掉色和高光處容易染色等若干缺點。1994年英國攝影師邁克.威爾（Mike Ware）的改良型氰版重新 將氰版帶回了現代顯影工藝的舞台之上，並以紀念赫歇爾的原始創新而將其命名為「新氰版顯影」（New Cyanotype）。不同於傳統 的氰版，新的氰版配方具有非常長的保存期限，對波長320到450奈米波長的光敏感，可產生穩定的普魯士藍於紙張和天然纖維上，並且該圖像在平滑的漸變色階上有出色的顏色表現，圖像對比度也比舊氰版好上許多，並且成品顏色可以通過各種化學方式輕鬆調色。例如茶染就是一種非常經典的手段。先利用氨溶液（每公升水250cc）或硼砂（每公升水70g）來漂白氰版織物，漂白過後的作品會變成淡淡的黃褐色，之後再將漂白過的作品浸入到紅茶中，利用紅茶中的單寧酸和氰版成品中的三價鐵反應，進而將漂白過的部份轉換為黑褐色。單寧酸不只存在於紅茶之中，貓尿、葡萄皮、紅酒、柿子，以及本次展覽中所使用到的五倍子染液中也都富含此成 份。

由於自製感光墨水的技術和價格門檻，和與商業導向廠商的溝通成本，赫歇爾的簡易舊氰版配方成為了雷射染計劃初期原型（rapidprototype）的感光配方，也就是檸檬酸鐵銨混合鐵氰化鉀而得到的感光性較低的顯影液，並成功的在棉布上留下不錯的藍色成像。由於使用單波長的雷射來進行曝光，效率遠遠不及以太陽光或紫外燈做為光源的傳統曝光流程，為了縮短雷射掃描的曝光時間，無意間的，我開始探索其它能取代赫歇爾氰版的DIY選擇，才開始對顯影工藝這項古老、且經典的領域有了初步的認識。例如 屬於銀鹽顯影工藝的凡戴克棕版（Vandyke Brown），亦嘗試過提高傳統氰版配方中檸檬酸鐵銨的劑量十倍，最後才找到邁克·威爾的新氰版配方。因為環保考量，我省略了新氰版裡其中一個重金屬配方重鉻酸鉀，成品仍然具有良好的品質。在這三種顯影工藝裡面，邁克·威爾的新氰版配方感光性和成像品質和工序簡易性都是最好的，具有較高的成品良率。凡戴克棕版雖然也具有良好的感光 性，亦能帶來由紅棕到黑等色系上的豐富變化，不過配方中的硝酸銀的腐蝕性太強，且凡戴克棕版顯影定色步驟相對繁瑣。更重要的是，這些都是不需要暗房就能夠執行的選項，使雷射染的工作環境較不受限制。

Must Seek The New in The Old

Siegfried Zielinski, who invents the concept of"media archeaology", argues that rather than seeking the old in the new, creating the precedents that the past will always obligingly furnish, we must seek the new in the old. By doing so, ethno-historian Greg Dening writes, we 'return to the past the past's own present, a present with all the possibilities still in it, with all the consequences of actions still unknown'.

Between 1839 and 1842, British John Herschel, the inventor of cyanotype, conducted hundreds of experiments on silver hailde, metal and plant's photosensitivity, including potassium ferricyanide. After Dr. Alfred Smee's generous sharing of reined potassium ferricyanide, they worked together to try on many chemical and photo reactions that eventually resulted in the classical photographic printing technique of cyanotype. Combining potassium ferricyanide and ferric ammonium citrate, after the solar exposure, lasting blue images would remain on the base paper or cloth. The name cyanotype derives from the element, cyanide, in the formula, and the process is also referred as blueprints due to the result color.

Anna Atkins created a series of cyanotype limited-edition books that documented feathers, ferns and other plant life from her extensive seaweed collection. Her name almost represents the cyanotype. Her father, a botanist, is a friend of Herschel's. Their accommodation was only thirty miles away from Kent, England. There was no direct evidence suggesting that she learned cyanotype from Herschel, but it is highly likely the reason for her to document plants with cyanotype since early years. Anna Atkins placed specimens directly onto coated paper, published Photographs of British Algae: Cyanotype Impressions and considered the first photographer in the human history.

The same technique sometimes could be dominated by different points of view. In 1984, the largest gold mine, Witwatersrand, was found on a remote ranch in Transvaal Republic (today's South African Republic). The mining profits and taxes launched the development of the republic, but also hastened the conflicts between the Dutch-dominated republic and British South African colony. After thirty years, in the Second Boer War, the cyanotype developed by Herschel and Atkins was used to print stamps and banknotes by the British troops in the siege of Mafeking. Then British Baden-Powell, how lead the defense force in Mafeking, ordered the photographer

E.J Ross to design five versions of one pound note, to produce a hundred copies each version using the cyanotype technique. Though these bank notes have entered the real current circulation; most are in the keep of collectors. Stamps have two versions, both in the theme of the Mafeking siege with the portrait of Baden-Powell. The cyanotype kicked start the beginning of image reproduction in the human history, and reached its peak in the early 20th century. After the emergence of silver halide and Kodak films, the cyanotype finally withdrew from the stage, with the only exception of blueprint used in the architecture industry.

Between 1920 and 1950, the technique of the cyanotype remains marginal, nothing more than a synonym to a technique of reproduction. Until the 1960s, some contemporary photographer attempting to go beyond the directionality of film-based photography started to produce images using non-traditional materials. Against simply using Kodak films in photography, they started to advocate for making own photographic paper by applying the cyanotype solution on the receptive surface. Until this moment, the cyanotype makes an comeback to be part of the contemporary photography art.

So much with the easy-to-made solution and low cost, the traditional cyanotype however cannot guarantee the best quality of images. Long exposure time, solution that is hard-to-maintain, problem of color fastness in washing and photosensitivity under strong lights are all among its disadvantages. In 1994, photographer Mike Ware introduced an improved version of the cyanotype to the world of modern image development. As an homage to the original version developed by Herschel, he named it the New Cyanotype. Unlike the traditional version, the New Cyanotype solution could last for longer time, it reacts to wavelenth 320 nm to 450 nm very well, it can develop stable Prussian blue images on paper and natural fiber. The new cyanotype produces beautiful images with excellent linear gradient effects and color contrast, which are possible for further toning through other chemical combinations. For example, toning with black tea is one of the classic approaches. First of all, bleach the cyanotype work with ammonia solution (250cc per one liter of water) or borax solution (70g per one liter of water). Dip the bleached yellowish cloth into the black tea. Tannic acid in the black tea solution will interact with ferric compounds of the cyanotype work to turn the color blue into dark brown. In addition to black tea, tannic acid also exists in cat's urine, grape skin, wine, persimmon and the Chinise gall which was used in the exhibition.

Considering the technological and financial barriers of self-made solution and the cost of communicating with commercial suppliers, the formula of the traditional cyanotype developed by Herschel was adopted as the light sensitive solution in the initial rapid prototype of the Laser Dye Project. By combining potassium ferricyanide and ferric ammonium citrate, the comparatively less sensitive solution still successfully left nice enough blue images on the cotton cloth.

However the efficiency of the single-wavelength laser exposure cannot compare with the solar source in the traditional process, in order to reduce the exposure time. Unexpectedly, bcause of the Laser Dye Project, I started a self-taught trip for the basic understanding of this old, but classic alternative photogrphy technique. To explore other DIY option to replace the Herschel formula, including silver process like Van Dyke brown, or experimenting with ten times ferric ammonium citrate in the traditional formula. Eventually, I settled down with Mike Ware' s New Cyanotype formula. Out of environmental concerns, one ingredient, potassium dichromate, is left out and that does not impact the quality of images so much. Among three methods, The New Cyanotype formula enjoys high photo-sen- sitivity, easy-to-follow steps and a high yield rate. Van Dyke brown printing also enjoys good photosensitivity and produces interesting colorful variations from red-brown to dark. However, one ingredient of the formula, silver nitrate, is strong in causticity and the color fixation process is relatively complicated. More importantly, these are options that can be performed without a darkroom, making the environment of Laser Dye Project less restricted.

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1985的布昌提之橋，新氰版顯影，邁克·威爾

Bridge at Buchanty 1985，New Cyanotype, Mike Ware

另一個起點

場景再度往前撥回到1952年，瑪麗·艾倫·布特（Mary Ellen Bute）和貝爾實驗室的波特博士（Dr.Ralph Potter, of the Bell Telephone Laboratories）合作的實驗影片「Abstronics」，大概是最能代表創作者的渴望將科技和藝術結合在一起的典範，以及「聽見」影像的嘗試。如同六零年代那些當代攝影師透過重新使用氰版顯影來拓展當代攝影範疇的企圖，瑪麗·艾倫·布特相信油畫的畫框限制了一切，並試圖在電子學的世界中尋找藝術表現方式。她積極的尋找有節奏的控制光線做為藝術表現的方式，她本來想和俄國人里昂·特雷門合作，利用他發明的電子樂器，同樣也以他的名字命名的電子樂器「Theremin」來製作聲光同步的實驗作品，但這個合作因為戰爭的爆發而作罷。儘管如此她仍不斷的尋找和數學家、科學家、工程師合作，最後才完成了「Abstronics」這件有電子示波器圖像參與的實驗影片，並開創了一系列早期的音像藝術（Audiovisual）實驗影片。

「通過旋轉控制板上的旋鈕和開關，我可以像使用刷子一樣自由地用光束『畫圖』。 由於圖形和表格是由示波器屏幕上的光產生的，因此它們會在電影膠片上拍攝。 通過仔細的有意識的重複和實驗，我積累了許多形式的系列。 創新的可能性是無限的。 通過更改和控制示波器中的電壓輸入，可以使無數種形式按照預定的時間節奏移動，並可以隨意組合或更改。」—瑪麗·艾倫·布特

在雷射染計劃開始的前幾年，因為缺乏繪畫訓練也產生了類似的想法，由於商用雷射舞台機器的昂貴，因此開始想要駕馭並破解這些雷射機器，以製造自己的便宜版本，我在網路上收集到許多關於如何製造它們的資料，但是因為對差分信號和耦合直流電壓信號特質的理解不足，使得開發時間增加了數月，這是決定自行開發的代價，但是好處是了解了這些電學原理後，現在能以更便宜的方式來拼湊組合只擁有必要零件的高品質雷射機模組。

當初接觸到「雷射沉浸式音像裝置」（laser audiovisual）這種創作形式是受到了阿爾瓦·諾托（Alva Noto）和羅伯特·亨克（Robert Henke）的作品影響，很幸運的我親自受到了羅伯特·亨克的一些指引，在幾次電子郵件的通信中，他分享了如何用類比電壓信號控制雷射影像的電子學概念，雖然他並沒有告訴我實際的作法，但透過幾週在網路上收集到的資料，已足夠自行製造雷射機的硬體部份和通訊介面，並且在圖像介面編程環境中Max/msp製造了自己的軟體控制介面，開始可以利用波型混合的方式來製造出任何自己想要的雷射圖像。現在我可以在腦中直接將想要的雷射投影圖像反推回控制雷射機器的兩個X和Y頻道中的類比電壓和矢量資料。例如說如果期待在牆上用雷射機投射出一個三角形，即可以馬上推算需要輸入怎樣的類比電壓到雷射機上。

最早使用雷射光在藝術領域的例子可以追溯到1969年愛沙·嘉米爾的作品「雷射噪點」和「雷射光牆」。在那個雷射二極體還只是實驗室裡奢侈品的年代裡，愛沙·嘉米爾將他對科學的深度理解轉換成了具有觀賞價值的精密儀器。兩三年之後，在一部實驗電影「紅色星球之死」（The Death of The Red Planet）中，導演戴爾·培爾頓邀請她使用氬雷射為影片製作了動態的雷射效果，並且由編曲家貝瑞·舒拉得（Barry Schrader）藉由經典的電子聲音合成器Buchla 200 system為電影製作了音樂，這也許成為了史上最早的「沉浸式藝術」或「視聽藝術」（audiovisual）的例子。

Another beginning

Let's go back to 1954 when Abstronics, the experimental film produced by the artist Mary Ellen Bute and Dr.Ralph Potter of the Bell Telephone Laboratories, best illustrates the aspiration of creators to combine art and technology. Just like those photographers of the 1960s who attempted to expand the scope of the contemporary photography by rebooting the cyanotype, Mary Ellen Bute also believed that painting was not flexible enough and too confined within its frame and tried to look for new mode of artistic expressions in the world of electrons (or subatoms). She actively sought for a device for the free control of light and form in movement, synchronized with sound, and thought about collaborating with Russian musician, Leon Theremin, and his invented electronic musical instrument bearing his own name, "Theremin". However the aspiration was interrupted by the war. Nevertheless, she still looked for new collaborations with mathematicians, scientists and engineers and eventually came up with Abstronics, an art film composed upon mathematical formulae and presented with colors and images of Oscilloscope.

"By turning knobs and switches on a control board I can 'draw' with a beam of light with as much freedom as with a brush. As the figures and forms are produced by light on the oscilloscope screen, they are photographed on motion picture film. By careful conscious repetition and experiment, I have accumulated a 'repertoire' of forms. The creative possibilities are limitless. By changing and controlling the electrical inputs in the scope, an infinite variety of forms can be made to move in predetermined time rhythms, and be combined or altered at will." - Mary Ellen Bute

In the first years after launching the Laser Dye Project, my lack of painting trainings also led to a similar idea. The high cost of commercial laser lighting machines drove me to studying these machines and come up with my own cheaper version. I collected numerous data about building own laser light machines, however my lack of prior knowledge of differential signaling and coupling isolated circuits dragged out the entire development process for couples of months. That is the price I have to pay for choosing building my one machines. In exchange, equipped with knowledge of the science of electricity, now I can assemble high-quality laser lighting machines with necessary components in a more cost-effective way.

The beginning of my attempts for works like immersive laser audiovisual equipments was influenced by works of Alva Noto and Robert Henke. Luckily I had some insights from Robert personally. During few emails he described the way to control the laser machines by hacking the ILDA protocols with analog signals. Although he didn't tell me the exact way to do it but I still managed to build my system after weeks of online research. Now I can picture and calculate nearly exact analog signals with the right wave length to form the structures to feed in the laser machine in order to project the correct laser graphics I pictured in my mind.

The earliest cases of using laser light in artistic presentations can be traced back to the "Laser noises" and "Laser wall" done by Elsa Garmire in 1969. In the era when the laser diodes were still lab luxury, Elsa Garmire transformed her scientific knowledge into a precision instrument for audience. After a couple of years, in the experimental film, The Death of the Red Planet, director Dale Pelton invited Garmire to create moving patterns with argon laser beams and set them to music composed by Barry Schrader with classical electrical synthesizer, Buchla 200 system. This may be considered the first ever example of "immersive art" or "audiovisual art."

Quoted from Dale Pelton in 1973 on American Cinematographer: "Two-and-one-half years ago, I met Dr. Elsa Garmire, a member of the research faculty at the California Institute of Technology. I visited her at the Caltech physics laboratory, witnessed a laser demonstration and was amazed by the laser-generated random flashes of delicate, sometimes spidery, sometimes globular, fiery light patterns. The laser images never had the appearance of mechanical or computer-generated images. They did not look like products of our humanoid technology. While they were abstract, they were also organic, at once microcosmic and macrocosmic. The constantly evolving forms sometimes appeared as living tissue and at other times, like creatures found in some distant unknown part of the universe. I was so enraptured that i decided to make a film solely of these creatures of light."

Gamire told Science & Film, "there was a standard way of putting X-Y mirrors on the laser and getting what us scientist's call Lissajous figures(or harmonograph), which are sort of ovals. You can get lots of ovals of different sizes, moving in different directions, and you can run them with music and get a kind of wild pattern that to me has no aesthetic value at all."

After The Death of the Red Planet, the application of laser in the computer art has gradually become a common practice. In addition to expressions of special lighting and forms by laser light in the artistic world, the laser technology has been widely adopted by electronic industry, space industry, biology, archeology, quantum mechanics and arts. I look at the laser as a functional "cultural object." In more than five decades of evolution of "laser art,"as a technological medium, the multitude of laser applications have been widely discussed, especially in terms of the cohesive between arts and science. How the application of laser connect the developmental trajectories of science, technology and arts? Turning technological medias into cultural objects, and then into the museum collection, one of the first cases is the acquisition of computer viruses by the Museum Angewandte Kunst (Museum Applied Art) in Frankfurt in 2002. The acquisition was conducted by Dr. Franziska Nori, the curator for the exhibition of I Love You. Dr. Nori emphasized the active role of museum in preserving and defining cultural memories:"In addition to collecting and preserving objects, a museum's purpose is to provide cultural contexts and distinctions, whereby the observer is encouraged to rethink his or her own perception of the world of things. Not only do museums serve as a society's cultural memory, they are also places for communicating and research- ing the new realities and models which are relevant to society. The paramount question: What is digital culture today and what will it become in the age of the information society? not only determines the direction of today's artistic production but should also encourage cultural institutions to examine their own task. Looking back to the ambitious expansion of the contemporary photography through the cyanotype by the photographers of the 1960s, this exhibition, in a similar approach, also attempts to create transdisciplinary dialogues through connecting cultural medias, to expanding the new media art context.
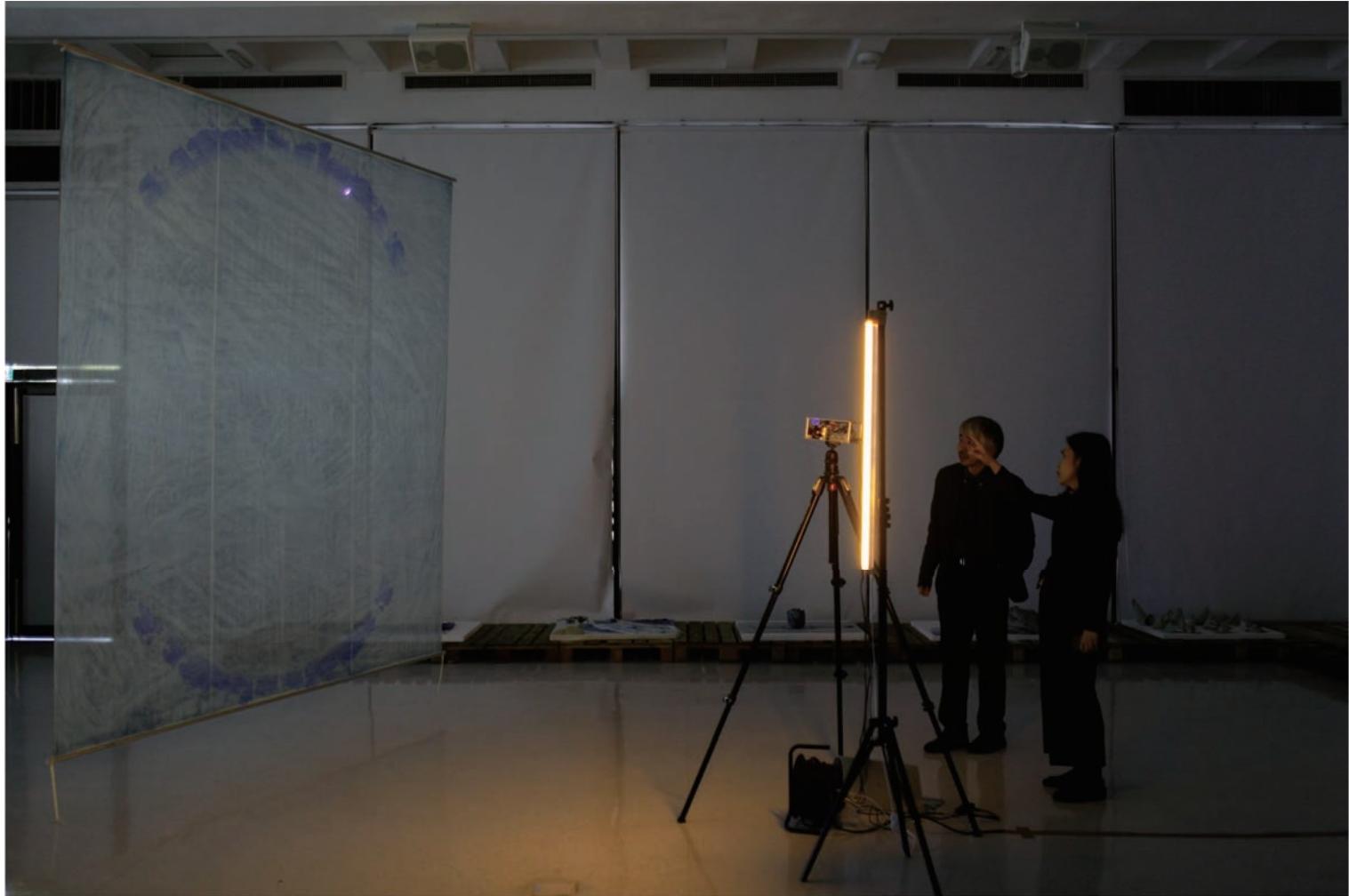
展場主裝置於展覽開幕日中利用雷射投影進行現場曝光。受程式控制的雷射光點在塗佈好顯影液的生絲上以不同的速度移動來製造顯影的深淺。

The main art installation was being made by real-time laser exposure. The programed laser dots was moving in varying speed on the silk fabric, pre-coated with sensitizer, to create graphic denstity.

考古學中的想像媒體機器

透過挖掘媒體物歷史，如雷射染計劃、氰版顯影、雷射藝術，甚至是下一章將介紹的社群，我們想介紹利用媒體物歷史做為創作方法的例子。聲光藝術藝術家兼研究者德瑞克·霍什（Derek Holzer），他在2019年的碩士論文「Vector Synthesis」引用「媒體考古學」為創作方法。藉由反向重新利用早期示波器的顯示元件–陰極射線管等和雷射投影機等同一類控制技術成為藝術表現工具，反向探索當年二戰時期和冷戰時期下在核子恐懼下被開發出來的戰爭技術成為了許多電腦藝術表現形式的意識起源，以及技術機械和意識形態生成的彼此譜系理解。這種理解能深遠的影響未來媒體和各種文化、社會、經濟間的互動關係。他鉅細靡遺的介紹了如何使用老式示波器和陰極射線管製造和聲音具有同步關係的音像藝術，並在開源程式環境Pure Data中開發了一系列控制示波器藝術影像的程式碼。

摩德施（Armin Modesch, 2006）指出，技術科學是將技術決定論的意識形態付諸實踐的努力，例如現代的電動遊戲、當代藝術、新媒體藝術中的虛擬實境、人工智慧、人工生命等技術都採用了來自於二戰、冷戰、核戰危機時代等技術遺產概念。技術和物件可能會凋零，但是其背後的意識形態從未完全死去，未來可能所有的新媒體都包含了過去意識形態的復活和重新混種。摩德施對冷戰時代電腦計算的分析，指出機器的意識形態代理無所不在，而且很少被人們察覺。

當代媒體考古學者尤西·帕里卡（Jussi Parikka, 2012）認為重新使用舊媒體是媒體考古的重要概念，我們可以將任何人造物視為媒體，和過去文明進行對話，以及思考這些技術如何和人的感知互動，進而對新舊媒體的本質進行重新發明與設計，啟發我們對未來媒體機器設計的可能性。他重新改進了「死媒體」（dead media）的概念，並另外提出了「僵屍媒體」（zombie media）的概念，稱舊媒體或傳統媒體從未真正的死亡，我們可以經由檢視其衰敗、腐爛、變革、混種之過程，透過重新使用這些舊媒體來挖掘被遺忘的理念（forgotten ideas）。他認為媒體物有自己的視角，可以用「物的傳記」來理解，讓物自身說話，並透過這種改造過程，和非線性的敘事方式，媒體考古學可以是一種進行媒體設計和藝術創作的方法。

以同樣斷裂的敘事方式和藉由雷射染計劃本身做為媒體物的「傳記角度」來觀看當代媒體技術和傳統工藝媒體的合作，和進入雷射染計劃曾經參與過的社群歷史，並想像未來可能形成的新媒體機器和生產系統。這次的天然纖維與雷射染實驗計劃連結了雷射藝術和天然染色工藝兩種文化媒體，為跨域的未來合作提供了初始的思考支點和領域、跨時度對話的想像實驗。相較於示波器電腦藝術所連結的軍事歷史，類比此反向考古重演，將挖掘文本的方法轉換成探索物質的方法，使我們可能透過構樹、薯榔等天然材料進入南島語族的遷移史，探討東南亞與太平洋區塊的多樣性，或是以構樹材料做為進入造紙工業史的起點，染材方面也有紫膠蟲曾經做為早期黑膠唱盤原料的歷史等，為混合傳統工藝材料和現代材料學為主軸的實驗工藝計劃提供更多的研究方法，在政治、文化上的描繪出新舊媒體間的緊密關係，為設計建立新媒體藝術和傳統工藝領域的一個未來想像基礎。
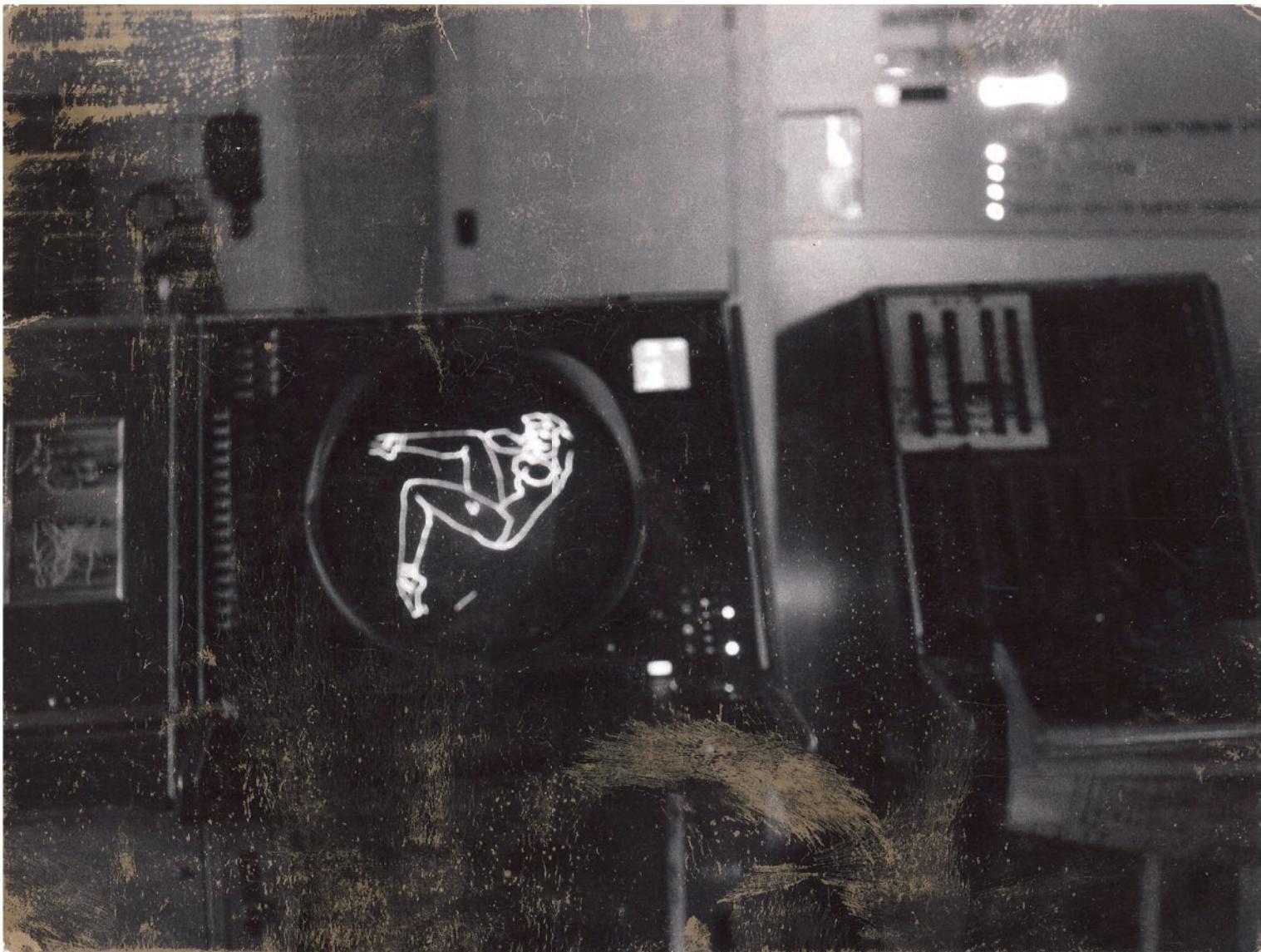
美軍賢者地面防衛系統的開機畫面可能是電腦影像藝術的起源，其螢幕技術概念和雷射染計劃中所使用的技術類似。該畫面是由美國空軍勞倫斯·提普頓於1959年以拍立得相機拍下。

The booting screen of SAGE (semi automatic ground environment) was probably the origin of the computer art. The technical concept of the displying technology is similar to the technology of the DIY laser machine in Laser Dye Project. This Polaroid photograph was snapped by U.S airman Lawrence. Tipton in early 1959.

An Imaginary Machine in Media Archeology

Through excavating the history of medias such as Laser Dye Project, cyanotype, laser art, or even commnities which will be introduced in the next chapter, we want to introduce historical theories. The sound+light artist and researcher Derek Holzer in his 2019 master thesis, Vector Synthesis, conducted a media archaeological investigation. Via reuse of display components of early oscilloscopes, cathode-ray tubes and laser projectors in artistic expression, he attempted to retrace the ideological origin of contemporary computer art in the war technologies developed in WWII and the Cold War under the public sentiment of nucleomituphobia, while establishing the genealogical relationship between technological machines and ideologies. This knowledge deeply affects the interaction among future media and the cultural, societal and economic aspects of our world. He demonstrated in details how those ancient oscilloscopes and cathode-ray tubes produce images in analogue to sounds, and developed a series of codes to control artistic images produced by the oscilloscopes on the Pure Data, an open-sourced environment.

Armin Modesch (2006) pointed out that the science of technology is the efforts of implementing technological determinism. He mentioned that the technologies of modern video games, contemporary arts, virtual reality of new media art, artificial intelligence and artificial life have all adopted the ideological legacy of technologies developed in WWII, the Cold War and the crisis of nuclear threats. Technologies and objects may fade out, but the ideologies behind will never completely die out. Every possible future new media is a revival of and hybrid with past ideologies. Modesch's analysis of the Cold War era computing indicates that the ideological agency of machines is both omnipresent and somehow rarely acknowledged.

Contemporary media archeologist Jussi parikka believes that the reuse of old media is essential to media archeology. We may view any artificial object as a medium to dialogue with past civilizations, and to reflect how those technologies interact with our perceptions for further reinventing and redesigning the nature of the old and the new. In this way new possibilities of future machine design will open. He looks into the idea of the 'dead media' and replaces it with the "zombie media." Old or traditional media has never died, but is undergoing a process of decaying, decomposing, transforming and hybridizing. Through reusing old media to re-excavate forgotten ideas, he believed to let objects speak for themselves. The media objects have their own perspectives that could be understood as the biography of things. With reinvention and disrupted (discontinuous) narratives, media archeology may work as the methodology for media design and artistic creation.

With the similar approach of disrupted narratives, this exhibition intends to explore the collaboration between contemporary media technology and traditional crafts as well as the history of my participation in several communities before the Laser Dye Project, from the biographical perspective of the Laser Dye Project. From here, we will imagine what shape the future media machine and production system may take. The Natural Fiber and Laser Dye Project connects two distinctive cultural media - laser art and natural dye, and serves as a starting point for initial dialogues of the tans-disciplinary collaboration. Compared to the military history revealed by the computing art of oscilloscopes, our archeological excavation reveals the migratory history of paper mulberry and shoulang yam into the south Pacific islands and the diversity in Southeast Asia and the Pacific. Paper mulberry sets out explorations into the industry of papermaking while learning that lac insects had been harvested for making early LP. All of them provide a multitude of approaches to the experimental craft project focusing on the hybridity of traditional craft materials and modern material science. By politically and culturally mapping the intimate relationship between new and old media, this project expects to open up a new horizon for both new media art and traditional crafts.

「Craftalline」，展覽入口裝置，由新氰版顯影製作於薄蠶絲上，由405奈米波長，250毫瓦的雷射光源進行曝光，兩塊蠶絲布面積各為3米平方，左邊和右邊的曝光時間各為28小時和16小時，圖像的內容是利用程式模仿水晶的碎形結構而生成的數位印花。

Craftaline, was the main art installation of the exhibition. It was made using a New Cyanotype technique on two real silk canvas, 405 nm / 250 mW laser source as exposure light. Each canvas is 3 x 3 meters in size, the exposure time was 28 hours for the one on the left and 16 hours for the one on the right. The digital pattern is designed with generative code inspired by the fractal structure of crystal growing.

獨立的營—全球化中的散居部落
The Individual Camps -
The Tribalism in the Globalism

雷射染計劃是一個跨學科且「遊牧」的計劃，受到互聯網的催化，參與了和不同社群的交流和合作，並間接產生了國際間特定社群彼此間的交流聯繫。這些社群包括了自造者、科學家、藝術家、文化研究者、民族文化保存者、社區營造者。雷射染計劃的遊牧也見證了這些自治的「營」的建立和營運，以及其所組成的網路成為新的生產系統的潛在性。

The Laser Dye Project is an transdisciplinary, individual, and nomadic project catalyzed by the Internet. Through its collaboration with different communities, it has indirectly growed links between specific communities of makers, scientists, artists, cultural researchers, national culture preservers, and community builders worldwidely. The nomads of the Laser Dye Project have also witnessed the establishment and operation of these non-capital "camps" internationally and their potential to innovate a new production systems.
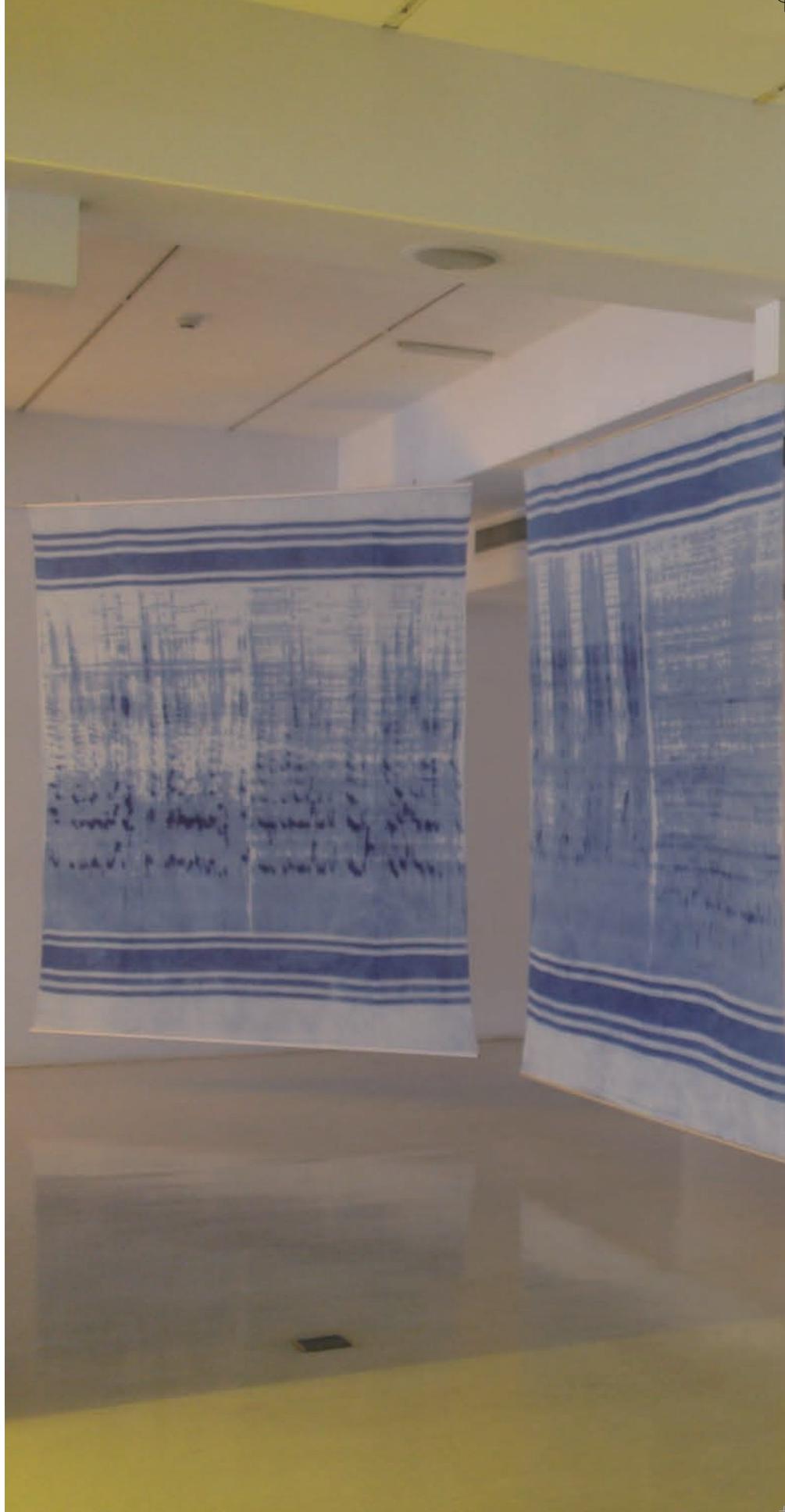
科學民主的壁畫和自游牧中誕生的不穩定社群

在1994年法國南部的拉斯科(Lascaux)，一個洞穴入口被發現，並且在裡面發現了一批史前壁畫。這些壁畫具有1.2萬年以上的歷史，被視為人類具有複雜心靈活動最早的證據，這些壁畫內容通常是動物的群體或是人和動物的混合群體，沒有人知道為什麼這些壁畫都是被發現於洞穴的最深處，即光線無法抵達之處，也許是在黑暗中才能召喚心靈，在火把旁，遠古的人們集聚在石壁下，在微光中凝視著自己的作品。

「服誌」是電子織品藝術和台灣泰雅族文化合作的實驗計劃「部落對抗機器」中的一個實驗發想，意思是結合「服」的形式和「誌」的紀錄特質，想像並開啟一種結合穿戴媒體和文化典藏功能的討論，和如何利用數位通訊媒體「發生即典藏」的特性做為部落服飾數位化的發想起點。這件由四組長寬各2.5米印花構成的裝置，延續了「服誌」中以織物設計為典藏形態的概念，改由雷射染技術重新製作，以雷射染計劃本體的主觀視角，將典藏內容由民族文化置換為雷射染計劃曾經拜訪過的國際社群。該四面印花圖樣利用俄國音樂軟體開發者亞歷山大·梭洛多夫(Alexander Zolotov)所設計的開源軟體「PhonoPaper」製作，將20秒聲音檔轉換成四組時頻譜(spectrogram)並印製在薄織棉布。「PhonoPaper」是關於聲音的圖形表現形式的研究。梭洛多夫不只製造了PhonoPaper，他最為人所知的是他多年來持續的在線上製作了許多製作音樂用的開源軟體和電子硬體，其中大部份是開源的，大大的幫助和啟發了許多音樂工作者。四組時頻譜每張面積2.5米平方，曝光時間約12至18小時。這些取樣自雷射染計劃遊牧經驗的時頻譜，象徵了受益於開源精神和國際社群的合作型計劃。

四組聲檔分別是：野桐工坊負責人尤瑪達陸在「部落對抗機器」電子織品工作坊中介紹自己在泰雅織品圖紋典藏領域中的工作經驗、電子織品社群e-Textile Summer Camp創辦人里美·美嘉(Mika Satomi)2016年的活動開幕致詞、藝術家維多利亞·曼加尼亞(Victoria Manganiello)在紐約電子織品社群e-Textile Spring Break活動中介紹自己作品的片段，以及「部落對抗機器」在西藏青海的延伸計劃「溫室之心」中在玉樹縣上參與當地溫室建造的環境收音片段。

在拉斯科二號洞穴中的複製畫：拉科斯洞內總共有近五百餘幅繪畫，這些繪畫中有100多幅是動物繪畫，由礦石色粉完成。攝影：由傑克．福斯路特於2008年五月拍攝。

Reproduction of Lascaux artwork in Lascaux II, there are nearly 500 cave paintings were found in the cave, 100 of them are paintings of animal figures made of mineral pigments. Photographer: Jack Versloot, May 2008.

Cave Paintings of Autonomous Camps & Unstable Communities of Individual Nomads

In 1994, a cave with prehistoric wall paintings was discovered in Lascaux of southern France. These paintings can be traced to 12 thousands years ago and are considered as the earliest evidence of complex humanoid mental activities. The contents are usually of animal herds or of the hybrid breed of human beings and animals. No one knows why they exist in the depth of the cave, where no light can reach. Perhaps the darkness is fit for evoking the spiritual. By the torch, ancient human beings gathering by the cave wall gazed at their own works in the shimmering light.

In the 2017 the e-textile-based project of Tribe Against Machine, a cultural collaboration with the Atayal tribe, 'Fu-Zhi (wearable zine)' was one of the experiments to imagine and to stimulate the discussion between wearable media and cultural archive. It intended to kick start the digitization of tribal costumes through the approach of 'happening is archiving' employed by the digital communication media. This installation consists of four pieces of printed cotton cloth, each 2.5 square meters. Continuing the concept of "digital archiving in textile format" developed in 'Fu-Zhi (wearable zine)', this installation is printed with the laser dye technique to present the subjective perspective of the Laser Dye Project itself, but changeing the archiving content from ethnic culture to the four international communities that the Laser Dye Project had visited. This four prints are processed by the open-source app, PhonoPaper, developed by Russian music software maker Alexander Zolotov. PhonoPaper is an app transforming audio samples into spectrogram patterns and in this installation, each spectrogram consists of 20 seconds of audio sample extracted from the filed recording during the commnuity visiting. In addition to PhonoPaper, Zolotov continues to develop numerous programs and hardware for music production, mostly open-source, that help and inspire many music artists.Each canvas is 2.5 square meters in size, exposure time was between 12 to 18 hours. These spectrograms that resulted from the nomadic experience of Laser Dye Project symbolize the collective project that benefited from the spirit of open-source and international community activities.

Four spectrograms were converted from audio clips of: Yuma Taru, the leader of Lihang Studio and her introduction of archiving the Atayal traditional weaving patterns in the Tribe Against Machine workshop; Mika Satomi, the founder of the e-Textile Summer Camp and her opening speech in the 2016 camp; artist Victoria Manganiello and her introduction of own works in the New York e-Textile Spring Break; participation of Tribe Against Machine in building a local green house in Yushu, Tibet in an extension project, the Heart of the Green House.
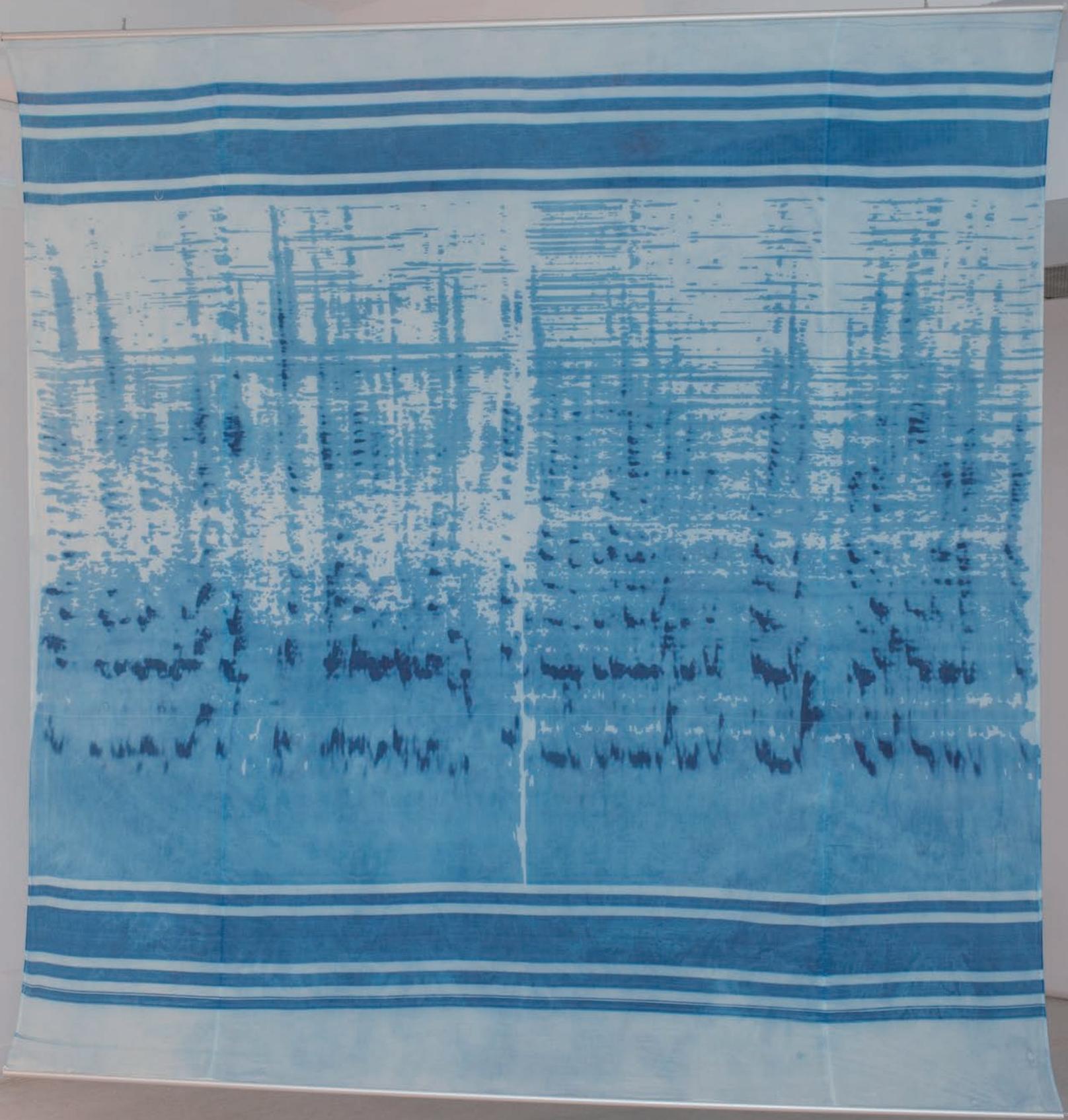
我常常直覺式思索除了在商業藝術市場生存外，藝術工作者有無可能創造新的生產系統？我們能否將「藝術」和實際的社會需求結合？尤其是媒體藝術工作者同時是技術持有者也是文化工作者的背景，這似乎助長了其創造跨域計畫的能力。基於這樣的動機和探索欲，2011-2019數年間在國際上參訪、組織了數個不同領域的社群或實驗計劃，如電子織品、電子音樂、國際義工、社區營造、生物藝術、DIY文化、開源科技等。參訪的方式都是以提出實驗計劃提案向對方申請參訪或是合作，例如以雷射染計劃申請國際工作坊或駐村，也許是所使用的媒介（實驗性質的新媒體計劃），進而決定了我所接觸到的社群和人物，這些社群都是由對實驗計劃具有高度熱忱的藝術工作者、學術研究者、科學家組成且自發性組織的，而非政府機構為中心的。這些社群透過以促進知識交流為主軸的年度集會或不定期工作坊保持著運作，來自支持同樣價值的友誼亦是維持社群運作的重要元素。社群是維持特定價值觀念的重要工具，這些價值包括公民科學、開放科學、開源軟體、開源硬體等。

游牧式的純然探索使我參與進入了數個這樣的社群，並且是在一種不連續的地理條件上。這些社群通過某些中心思想連結，卻又擁有各自的主體性，形成了一種不穩定且非上對下的分散式結構。透過這些社群的線上論壇、維基頁面便隨時可以和線上的蜂巢式智庫進行交換，或是馬上能找到對特定計劃需要的人力資源或技術支援，好似一種虛擬網路上的散居部落式社會。這個社會似乎又透過某種全球化的形式參與，加速了資訊的傳播，這些「全球化的形式」包括工作坊、「營」的文化、材料科學、藝術祭、和生產系統有關的社會設計，這些主題成為了社群間的共同語言促成交流。
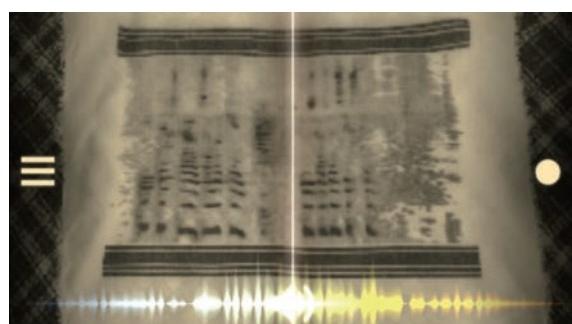
在手機軟體PhonoPaper中，利用手機相機將以雷射染印製的時頻譜印花轉換回為聲音。
The spectrogram printed by laser dye on canvas can be converted back to sound in PhonoPaper by the mobile camera.

Out of intuition, I often ponder the possibilities of artists to create a new production system outside of the existing commercial market of artworks. Can we connect 'art' with real social needs? My background as a media artist/technique bearer/cultural worker seems to contribute to the capacity of creating trans-disciplinary projects. Out of such motives and aspiration, I visited several international groups and organized various communal or experimental projects on e-textiles, electronic music, international volunteers, community development, bio-art, maker culture and open-source technology. Usually, I would propose experimental projects to host organizations, workshops or residency programs, such as the Laser Dye Project. The nature of the media that I use (experimental new media) determines that the communities and people I met are often self-organizing groups of highly energetic and experimental artists, researchers and scientists, rather than governmental agencies or institutions. These communities operate annual exchange meetings or irregular workshops; fellowship that supports the same values is the most essential element of these communities. These values include citizen science, open science, open-source programs and open-source hardware; the community is the key tool to uphold these values.

Nomadic exploration allows me to be part of several communities, geographically disconnected. They are bound by certain central values, operated independently, non-hierarchical, unstable and dispersed. On the internet forums or wiki sites, people can exchange information with the online beehive-like think tank at any time, or locate necessary human resources or technical assistances for any specific project- the tribal society dispersed in the virtual network. At the same time, through global exchanges such as workshops, camp culture, material science, art festivals and production system-related social design, information dissemination accelerates while common language is formulated.

技術決定論的爭辨往往誘導我們進入技術烏托邦（techno-utopianism）和技術如何決定權力分配的討論。關於烏托邦主義的討論是一個社會設計的思想競賽場域，在過往的時空裡各種烏托邦思想模型多次被提出比較。當俄國擁護了共產主義，義大利未來主義詩人菲利波·托馬索·馬里內蒂（Filippo Tommaso Marinetti）支持了莫索里尼時，馬可尼（無線電的發明人）和愛迪生（電話的發明者）建立了二十世紀初的電信網路商業帝國並壟斷了無線電和電話的市場，象徵了極權的技術烏托邦。
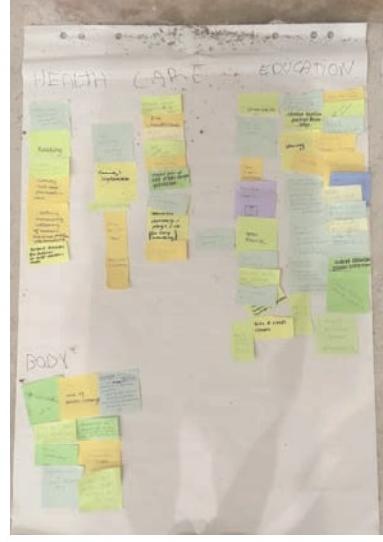
也許是對二十世紀初的技術烏托邦帶來的極權傾向的反動，德國劇作家和藝術理論家貝托特·布萊希特（Bertolt Brecht）提出的「廣播理論」一詞，對無線電廣播技術做出有史以來第一次對媒體功能的嚴格概述，他提出一種想像，廣播電台必須「使聽者不僅能聽，也能表達，反對孤立聽者，而是要在聽者和發送者之間建立關係。」即每個無線電收音機也應具有發送傳播的功能。沃爾特·班傑明（Walter Benjamin）的《作為生產者的作者》一文中也表達了類似主張，要求藝術家從事生產。藝術家不僅應該專注於製作偉大的作品，還應該全力以赴，使他人也成為製作人。

班傑明強調藝術應具有革命性概念，他指出，由於所有藝術（包括所有藝術生產形式，如繪畫、雕刻、出版、劇場排演方式……等）皆依靠著某種技術，因此它也屬於生產力的某種形式，而藝術技法（技術）也是。當藝術生產者無法和他的觀眾生產利益時，他便無法真正的擁有他的生產工具，藝術便容易流於操縱在少數具特權的人士手裡，使得藝術無法被大眾親近。作為一名身負有革命任務的藝術家，不應毫無批判地接受現存的藝術生產力(模式)，應力圖發展與革新這些力量，如此便可在藝術家與觀眾之間創造新的社會關係，使藝術自少數人手中解放出來。 在今日，相同的關於權力分配的爭論仍然持續著，只是主流媒體已經從廣播和電視轉為互聯網和網路社群媒體，如同谷歌和Livis合作的電子織品計劃Jacquard Project壟斷了觸控織品的專利，或是臉書使用者資料的擁有權歸屬，亞馬遜網路服務上對於人工智慧的養成方式等，這些媒體去中心化的思潮，專利和開源的辯論，在今日仍然是當代媒體的核心問題。這些價值的戰爭組成了我們生活的底層，只是大多數的時候這些戰爭是隱形的。

The debates of technological determinism often lure us into the discussion of techno-utopianism and power distribution. The discussion of utopia is an ideological coliseum of social designers. Many different utopian models have been debated and compared in the human history. When communism was enthroned in Russia, the Italian futurist Filippo Tommaso Marinetti supported Mussolini, Marconi (inventor of long distance radio transmission) and Edison (inventor of telephone) created the commercial telecommunications empire in the early twentieth century and dominated the market of radio transmission and telephone – the authoritarians of techno-utopianism.

Perhaps in reaction to the authoritarian tendency of the techno-utopianism in the early twentieth century, German dramatist and art theorist Bertolt Brecht published the 'radio as an apparatus of communication' as the first serious discussion of the communication functions of radio technology. He imagined that a radio station should be "if it knew how to receive as well as to transmit, how to let the listener speak as well as hear, how to bring him into a relationship instead of isolating him." The author of The Author As Producer, Walter Benjamin, also proposed a similar argument that artists should engage in production. In addition to masterpieces, artists shall endeavor to help others become producers as well.

Benjamin stressed that arts should be revolutionary. He pointed out that all arts (all forms of art production including painting, sculpture, publishing, theater and etc.) rely on certain techniques, a fact that makes them part of production. So do artistic techniques. When artists cannot engage their audiences in production, they are not the actual owners of their means of production. Thus arts tend to be dominated by certain privileged persons and become inaccessible to the public. As an artist obligated to revolution, s'he shall not accept the existing production system of arts without criticism, but endeavors to challenge it, librates arts from the few dominants by creating new social relationship between artists and audience. Today, similar debates on power distribution still carry on, except that the battlefield moves onto the internet and social media from radio and television. Examples like the patent monopoly of capacitive sensing textiles by the Jacquard Project, a collaboration between Google and Livis; the problematic ownership of Facebook user data; AI development of Amazon online services. The debates on decentralization of media, patent and open source are essential to contemporary media. The war of these values forms the bottom soil of our daily life, but mostly invisible to common eyes.

生產 / Production

大眾定制化	Mass-customizable
超個人化	personalized
程式化	Programmable
可回收	Recyclable
自調整服	Self-adjusting clothes
自適應鞋	Self-adapting Shoes
變形	Shape-changing
資源循環性	Resource Circularity
閉環製造	Closed-loop Manufacturing
零浪費	Zero Waste

手工藝 / Crafts

手工品的沿襲	Handicraft Lineage
自我學習	Self-learning
慢活	Slow
傳統技術	Traditional Technique

身體 / Body

去性別二元化	Non Gender Binary
可安裝的器官	Installable Organs
植入式配件	Accessories
溝通配件	Communication Implants
增強感官	Augmented Senses
體內軟電子	Body Soft Electronics
眼睛鏡頭配件	Vision Lens

教育 / Education

普遍	Universal
平等	Egalitarian
自由	Free
無障礙	Accessible
開源的	Open Source
知識實踐	Practical Knowledge-based
面向社區	Community-oriented
合作性	Collaborative
共享基礎設施	Shared Infrastructure
制度化	Institutionalized
工作坊如藝術創作	Workshop as Artwork

大自然 / Nature

生物相容	Bio-compatible
可持續性	Sustainable
共生	Symbiotic
自然為本	Nature-oriented
生物紡織品	Bio-textiles
樹木物聯網	Wood Wide Web
樹根為電線	Roots as Wires
跨物種溝通	Interspecies Communication
寵物智能的植物	Pet-intelligent Plant
復古機器寵物	Retro Robot Pet
村落外骨骼	Village Exoskeleton
自然無障礙	Nature Accessibility
鄉村生活	Live in Countryside
天地自然與身體的合一	

經濟 / Economy

非分層	Non-hierarchical
非貨幣性	Non-monetary
負擔得起	Affordable
消費最小化	Consumption minimization
長期生存可行性	Long-term viability
思想版權	Thought copyright
普遍收入	Universal income
收入平等	Income equality
共享與租用制度	Commons ownership and rent
終止私人積累的慾望	No desire for private accumulation
時基經濟	Time-based economy
社會安全網	Social safety net
均衡競爭	Balanced competition
當地勞動分配	Domestic distribution of labour
小型國家	Small countries
金權政體	Corpocracy
沒有工作貧困	No working poor
無富無窮	No rich, no poor

隱私 / Privacy

嵌入式屏蔽層	Embedded Shielding
防護服	Protective Clothing
反電子設備	Anti-electronics

e-Textile Summer Camp 2016的參與者們在便條紙上紀錄了關於電子織品科技如何影響烏托邦社會的各種潛在性。

種植生長 / Growing

可生物降解	Biodegradable
再生	Regenerating
可回收	Recyclable
適應性強	Adaptable
活的	Alive
自生電子	Self-growing electronics
自修織物	Self-repairing fabric
自療	Self-healing
生物/非生物共存	Living/Non-living Coexistence
電子農場	*Farming Electronics
自動準備食物的桌布	Food-preparing tablecloth
飢餓丸	Starvation Pills

衛生保健 / Healthcare

療癒	Healing
無污染	Non-polluting
全民免費醫療	Universal Free Healthcare
無處不在的幸福感	Pervasive Well-being
智能育兒服裝	Smart Childcare clothing
保姆毛衣	Babysitting Sweater
減輕疼痛服	Pain-minimizing clothing
幸福感測試衣服	Well-being measuring clothing
葡萄糖測量	Glucose first aid kit
癡呆症養老保健服	Dementia care clothing
休息開關	Time to just stop
代際衛生保健	Inter-generational Care
自我毀滅機制	Self-destruction Mechanism

社會性 / Social

社會可持續發展	Socially Sustainable
社區支持	Community Supporting
內在民主體制	Inherently Democratic Systems
賦權	Empowering
解放	Emancipated
平等	Egalitarian
可穿戴的翻譯器	Wearable Translator
包容性	All-Inclusive
無國界	Borderless
通用貨幣	Universal Currency
能變色皮膚	Color-changing skin
默城	Silent City

虛構的未來 / Fictional Futures

日常生活中的VR	VR in Daily Life
時間擴展機	Time-Expanding Device
搖滾明星神殿	Temple of Rock Stars
神奇	Magical
跨星際	Intergalactic
萬能魔杖	Universal Magical Wand
同音器	Syntonisation Device
編碼語言	Coded Language
完全嵌入式	Fully-embedded
用思想控制的紡織品	Thought-controlled Textiles
人體內化	In-human
非衰老	Non-aging
隱形斗篷	Invisibility Cloak
女托邦	Female-only Utopia

(非-) 物質性 / (Im-)Materiality

彈性	Flexibility
可變形的	Transformable
可彎曲的	Bendable
可重整的	reformable
可同化	Conformable
可壓縮	Squeezable
耐久	Durable
可洗	Washable
觸覺性	Tactile
堅固耐用	Robust
第六感	Sixth Sense
隱藏的	Hidden
隱形親密	Invisible Intimacy
透明	Transparent
整合式	Integrated
液體電子	Liquid Electronics
物質編譯器	Matter Compiler

能源 / Energy

活的	Alive
能源自給自足	Auto-sufficient
太陽能發電的	Solar-powered
免費電能泵	Free Energy Pump
電池	Battery
通用插座插座	Universal plugs + sockets
以身體動力供電的個人設備	Body-powered personal devices

The participants of e-Textile Summer Camp documented their thoughts about how e-textile technology affects the potential of utopian society.

e-Textile Summer Camp

2016年的夏天，在法國南部一個由廢棄紙工廠轉型的當代藝術中心（Les Moulins de Paillard）裡正在進行一個關於「軟托邦」（Softopia）的討論。e-Textile Summer Camp是由里美·美嘉（Mika Satomi）和漢娜·伯娜·威金森（Hanna Perner-Wilson）共同主持的一個年度性以電子織品藝術為核心的社團集會，每年約有20-30位來自不同國家的對電子織品藝術的愛好者或技術擁有者前往法國南部的Les Moulins de Paillard當代藝術中心進行七到十天的交流。這種由藝術家自發性發起的「營」（camp）常常是一種結合了假期氣氛和知識交流的一種年度性的學術場合。「Softpia」是該年的一場以電子織品技術為中心的腦力激盪，就電子織品、柔性織品、穿戴式科技對未來的社會影響進行討論。每年在大家前往活動以前，都會在線上共同討論並制定出該年的年度主題，還有大家有興趣的技術、概念方向，然後再制定出每年的工作坊內容、分組活動主題。由於每年參加的人員重複性偏高，這是一個好壞參半的現象，但也因為這樣，集會也逐漸發展出如大家庭一般的情誼。

我在2010年透過電商平台Sparkfun發現了導電縫線和由利亞·布希利（Leah Buechley）和網路電商Sparkfun共同開發的可被縫紉在織品上的微電腦模組「Lilypad」，開始思考結合這樣的異材質於作品之中，於2013年完成了這件結合十字繡和LED電路矩陣做為織品織紋的電子織品計劃《I am Very Happy I Hope Yopu Are Too》。由於當時在台灣並沒有社群進行類似電子織品的研討，我心血來潮在網路上以關鍵字「e-textile community」搜尋到了e-Textile Summer Camp的網站和集會，並興奮的寫信告知自己極度想要加入集會的想法，並向她介紹了我當時正在進行的十字繡電路計劃，她告訴我雖然今年的報名已經截止了，但她依然樂意特例邀請我參加他們的集會，當時真是太高興了！這樣的心情開啟了此後連續三年夏天都前往參與交流的旅程，在2015-2017年的集會中對於電容感應、壓電織品、記憶金屬絲、感光油墨、生物塑膠、織品天線、電磁波感應、織品揚聲器等材料應用領域建立了基礎的認識，還有觀察到各藝術家在電子織品表現法和應用面上的表現。在2015年的集會裡，我在該年的智慧油墨小組裡認識了感光油墨和氰版顯影的基礎，並且將雷射音像表演的研究與氰版顯影結合，創造了雷射染計劃。

I am Very Happy I Hope You are Too，手繡電路細節，施惟捷，2013

I am Very Happy I Hope You are Too, closeup of the hand-embroidered circuit made by Shih Wei Chieh, 2013

2016年的e-Textile Summer Camp的年主題Softopia, 大家在集體討論後再在白報紙上貼上自己的想法。

The year theme, The Utopia of Soft Circuit, at e-Textile Summer Camp 2016, inspiration of the topic are gathered after the group discussion.

e-Textile Summer Camp

In the summer of 2016, in Les Moulins de Paillard, an contemporary art center refurbished from an abandoned paper factory, hot discussions on Softopia ensued. The e-Textile Summer Camp is a communal gathering of e-textile enthusiasts or technique-bearers organized by Mika Satomi and Hanna Perner-Wilson. Every year, around twenty to thirty international participants come to Les Moulins de Paillard for an exchange camp of seven to ten days. This type of self-organized camps often is a scholastic arena of temporary nature, blending holiday and knowledge sharing. 'Softopia' is the annual theme of e-textile techniques; discussions spread over various impacts of e-textile, soft-textile and wearable technology on the future society. Before the actual camp, on the internet participants would discuss and determine the annual theme, list out technologies and conceptual directions of interest, and lay down workshops and thematic groups. Highly repetitive participants is a mixed phenommenon to community developement, however, it also helps to formulate the fellowship of a big family.

In 2010, on the e-business platform, Sparkfun, I found conductive threads and Lilypad, the sewable microcomputer for wearable projects, co-developed by Leah Buechley and Sparkfun. I started to think how to integrate these smart materials in my work and thus completed 'I am Very Happy I Hope You Are Too', an e-textile whose pattern was created with cross-stitch and LED circuit matrix. At the time, there was no e-textile related seminars or conferences in Taiwan, eventually I found the site of e-Textile Summer Camp and the gathering event by searching online blindly with the keyword "e-textile community". Enthusiastically I immediately wrote an email to the host and introduced my cross-stitched circuit project. Even though the registration deadline already passed, the organizers still invited me to the camp and made me completely thrilled. Following this emotion, I attended the camp in three consecutive summers from 2015 to 2017. I was able to establish basic knowledge of applications such as capacitive sensing, piezoelectric textiles, nitinol threads, photochromic ink, biodegradable plastic, textile antenna, electromagnetic induction, and textile speaker. It also provided ample opportunities to observe different e-textile applications and artistic expressions. In the 2015 gathering, I acquired basic knowledge of photochromic ink and the cyanotype in the smart ink group. Afterwards, I started to combine my old laser audiovisual project with the cyanotype and created the Laser Dye Project.

I am Very Happy I Hope You are Too, 施惟捷, 2013
I am Very Happy I Hope You are Too, Shih Wei Chieh, 2013
攝影 / photographer：Taku Kasuya

雷射染現場打印裝置展示於另一個電子織品社群集會，e-Textile Spring Break 2019，該活動舉辦於紐約北部的瓦沙克鎮。

The Laser Dye live printing installation presented during another e-textile community event, e-Textile Sprint Break 2019, which take placed in Wassaic, North of New York.

在紅茶菌工作坊中進行的雷射染，嘗試在乾燥過後的、脆弱且不平整的紅茶菌薄片上顯影，當時是使用舊氰版顯影進行曝光。

The laser dye experiment proceed during the kombucha workshop. It tries to expose image on the fragile, uneven, low surface irregularity, dried kombucha thin film. The exposure process exploited old cyanotype solution.

部落對抗機器2017, 2018

隨著自2007年開始的創客運動,創客中心在世界各地大幅度的快速增加,這些以工具為中心的空間使公眾可以直接訪問實驗室機器、中小型的機具,這導致了科學的民主化。不幸的是這些開放是有限度的;由於工具中心的意識形態,使得工具被使用的概念只集中在製造流程上的便利化,也就是說這些創客空間被使用的方式流於單一化且缺乏想像,這種現象反映在每一年的Maker Fair中,不斷重複的低科技裝置、缺乏概念性應用的突破。

類似的重複性疲態出現在e-Textile Summer Camp,這些重複性反映在社群內的工作坊內容、還有每年大多是由舊人組成的參與者陣容。該現象曾被參與者提出數次討論,以及活動繼續延續舉辦的必要性,這些討論內容包括經濟上的還有型態上的。曾經在2017年終於有了重大改變,該年的內容原本由只對內的工作坊和分組討論外,另外增加了論壇、電子織品短期學校、駐村計劃部份,但是這個大膽的擴張並沒有延續下去,在2018、2019年的活動又回到了只有對內舉辦的模式。

這樣的觀察使我有了想要將這些「閒置的」創客空間能量導向其他領域,以及為電子織品社群尋求新的文化腹地的想法。「Tribe Against Machine」計劃(部落對抗機器計劃)是2017年我和台灣的孵一間工作室、創客吧創客空間一起和泰雅族的野桐工坊合辦的一個文化交流計劃,邀請了11位來自e-Textile Summer Camp社群的藝術家和三位來自徵選的新媒體藝術家,在台中泰安鄉屬於泰雅村落的象鼻村中,和居民以及泰雅工藝者一起渡過了共食共作的十天工作坊。計畫的主旨是透過跨學科的交換方式,為來自不同領域的社群尋找共地,創造新的學科領域。2017年的活動建立了台灣第一次電子織品領域和民族文化織品領域的合作,並且在該年的年主題「服誌」下,兩個來自不同社會體系的社群跨過半個地球,完成了許多以泰雅文化和電子織品技術混合的原型作品。

Tribe Against Machine 2017, 2018

Under the Maker movement starting in 2017, Maker centers rapidly mushroom across the world. Those tool-centered spaces allow the public to directly get in touch with lab machines and small-to-medium equipments and thus contribute to democratization of sciences. Unfortunately the openness is quite limited; the ideology of the tool center limits its use to facilitating the production process. In other words, Maker spaces are often subject to homogenized lack-of-imagination activities. Similar phenomenon also can be seen in Maker fairs, full of repetitive low-tech devices and without conceptual breakthroughs.

Similar repetitive fatigue also occurred in the e-Textile Summer Camp, as found in the content of the workshops and the participation pool that mostly remains unchanged year after year. This phenomenon was discussed several times; the question of continuity, both financial and organizational, was raised. Finally, a big change was introduced in 2017 by adding a forum, short courses of e-textile and a residency program, besides the original close-door workshop and group discussions. However, the bold change stopped there; the Camp went back to the old track in 2018 and 2019.

However, this observation stimulated my idea to channel the 'idle' energy of Maker spaces to other arenas and to look for new cultural abodes for e-textile. Tribe Against Machine is a cultural exchange program collaborated with Taiwan's Foison Art, MakerBar and Lihang Studio of the Atayal tribe in 2017. We collaborated with eleven artists from the community of e-Textile Summer Camp and three voluntary new media artists. The invited artists, Atayal residents and local artisans spent ten days living and eating together in the Elephant Nose village of the Atayal tribe, located in Tai-An county, Taichung. The project purported to seek for a common ground for different communities and disciplines through cross-disciplinary exchanges, and to create new prospective eventually. The 2017 event created the first collaboration between e-textile and indigenous cultural textiles. Under the theme 'Fu-Zhi (Costume Record)', across the globe two communities of different social systems worked together to complete many hybrid prototypes combining Atayal culture and e-textile techniques.

Aniela Hoitink在部落對抗機器2018工作坊中介紹她在參加2017年部落對抗機器後的新嘗試：利用台灣特產的愛玉混合羊毛纖維製作出類似不織布的織品塊樣。

Aniela Hoitink introduced her new discovery inspired in the 2017 event in the 2018 Tribe Against Machine. She tried to mix gel of Aiyu, a Taiwanese fruit with wool as nonwoven fabric blocks.

其中一個由野桐工坊和國際藝術家合力完成的作品是一個嵌入了Lilypad，由Leah Beuchley開發的經典控制器，的傳統泰雅新娘頭飾複製品。根據國際藝術家和泰雅藝術家的共同靈感「不可見的力量」，這個泰雅新娘頭飾的頂端被改造成一個由銅線圈構成的天線，Lilypad根據天線收集到的電磁波內容，再決定是否讓頭飾兩側的伺服馬達轉動，以帶動兩條由珍珠串成的鍊子，這個互動過程啟發並轉化於傳統服飾能感應惡靈並保護新娘的概念。這件由經典電子織品元件和經典傳統泰雅服飾合成的作品也象徵了兩個社群合作的美好象徵。

Another work done by the the group is a replicant of the traditional Atayal bride headdress embedded with the classic control board for wearable device, invented by Leah Buechley, the Lilypad. According to the "invisible power" of the common inspiration of international artists and Atayal artists, the top of this Atayal bride headpiece was transformed into an antenna made of copper coils. Lilypad then decides whether to let the two servo motors to activate or not according to the electromagnetic wave content collected by the antenna. The motor rotates two chains of pearls. This process was inspired from the concept that the traditional costume has the power to protect the wearers from the evil spirits. The headpiece combined with classic traditional Atayal costumes and classic e-textile tools, materials also symbolize a wonderful sign of cooperation between the two communities.

雷射染計劃進駐於TeamVoid位於在南韓首爾的地下室工
作室，設計圍繞雷射染印製技術的機械手臂動作。
The Laser Dye Project at TeamVoid's basement
studio in Seuol, South Korea, to design the laser
dye printing orientated robot arm movements.

Another nomadic trip of the Laser Dye Project, a 10-days residency exchange programe collaborated with the new media art group TeamVoid in Seul. TeamVoid provides one Kuka iiwa 7 R800 to work with Laser Dye Project. It was the first time to test the Laser Dye Project with robot arm. Testings including:

1. Largest printing area with one-axis movement.

2. Real-time synchronization between arm movement and laser graphics.

3. Imaging stitching copporated with arm movement, printed on garment.

4. 270º orientation mapping on sneakers, the shoes printing process takes around 10 minutes.
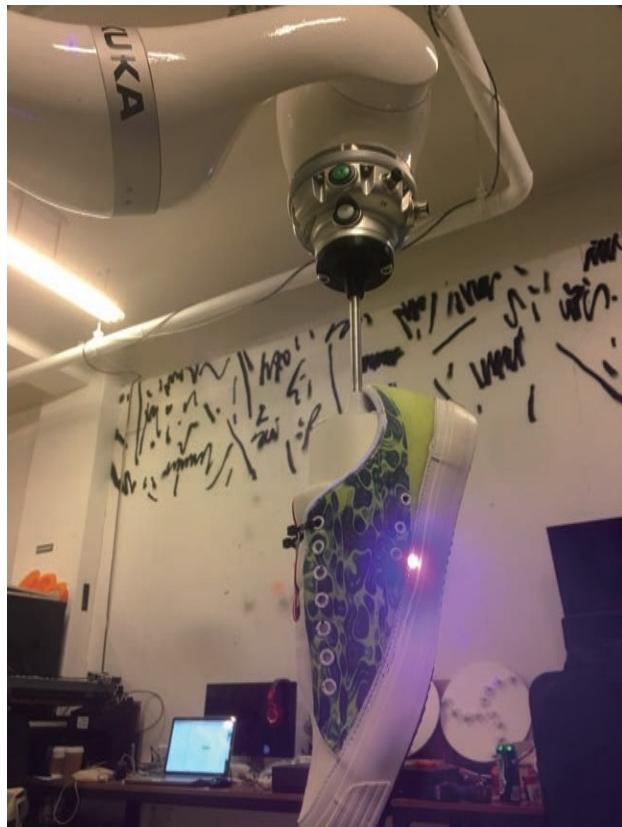
另一個雷射染計劃遊牧，和韓國數位藝術團體TeamVOID在首爾合作的十天駐村交換計畫，由對方提供一臺Kuka iiwa 7 R800結合雷射掃描印染。這是雷射染計劃第一次和Kuka合作，測試項目包括：

1. 單軸最大面積動作。

2. 手臂動作與雷射投影透過TCP/IP通訊同步。

4. 以手臂動作配合影像拼接，印製大圖在衣物上。

5. 270度鞋面打樣，整個鞋子印刷過程約為10分鐘。

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民主來自業餘─公民科學運動

在2018年「部落對抗機器計劃」受邀到深圳的Maker Faire成為主講座的內容之一。在深圳柴火造物中心的一場關於開源硬件平台GOSH（Gathering for Open Hardware Science）的分享講座上認識了其中一個組織委員，馬可・度些爾（Marc Dusseiller）。如同赫歇爾和史密彼此間無私的分享與合作精神，他們對彼此研究的單純熱情，使科學促進了文明的正面發展；透過舉辦工作坊和國際的「營」，生物藝術開源平台「Hackteria」的創辦人馬可在當代也積極的「重新」促進科學民主化和開源文化（open-source）的推廣。 公民科學還是一個相當新的名詞，但它卻是一個舊的做法。科學的發展在19世紀初原是仰賴於業餘者對科學的喜愛；業餘的英文「Amateur」源自1784-1786年拼法一樣的法文字「Amateur」，其拉丁原文是「Amatore」也就是愛的意思，Amateur是指「為愛所驅動，而不是為金錢所驅動去做事的人」，或是「對某件事耕耘並參與，如繪畫、科學、音樂，卻不將其做為職業且帶著營利的心態去做」，亦衍生自另一個具有貶義的字「dilettante」意指「戲水者、一知半解的人」。直到在20世紀科學開始被機構中心或政府僱用的科學人員所掌控，一直到70年代才有「科學重歸民主化」的聲音，主導科學的應該是「業餘的愛好者而非金錢偏見的技術官僚」。

「放上論壇！放上維基！」每次主動向馬可提出一些隨機的想法時，總是得到他近乎機械式和強迫症的回應。比如說想用雷射來做柿染定色，或是想在矽膠上用銀漿製作電路，儘管只是一個非常靈光一現且粗糙無比的想法，他也會想要我主動將其放上Hackteria的維基或是論壇。Hackteria擁有相當活躍的線上論壇和維基，秉持著推廣開源的精神，他總是無時無刻的鼓勵身邊所有的人積極的透過使用論壇交流，將所有點子紀錄和論壇上的蜂巢式的集合智庫分享。

由於策劃過部落對抗機器的原因，我對馬可這十幾年來不間斷的以非營利方式在開源社群的推廣、促進無國界的科學和藝術的合作感到敬佩。Hackteria不只是一個生物藝術開源組織，更是一個巨大的共和網路，連結著各式各樣的對推廣科技和藝術有著同樣積極精神的社群組織，曾有人形容馬可就是一顆松茸，他以有機且不可預測的方式持續生長著這些網絡。我在2019隨著馬可參訪了數個他的國際夥伴社群和他組織的工作坊，包括位於印尼日惹的藝術家自營社群LifePatch、日內瓦的Wormolution（蟲化世代）工作坊、位於瑞士路森市的Gaudilabs實驗室以及數個在瑞士的黑客空間。在這些參訪過程裡面我觀察到身為一個組織者和文化推廣者，馬可・度些爾用沒有階級的方式和週圍的人相處，他幾乎不置入任何特定的控制或預期目標在他組織的任何一個工作坊中，比如像成果發表、或是按照時間表做定時的集體討論，他更注重的是這些過程中潛性的、非顯性的交流。藝術家和科學家自由的用自己的習慣的步調節奏去參與每一個工作坊的部份。

去界定一個生產系統是否確立是一件很不容易的問題，例如雷射染計劃的遊牧，馬可的國際開源生物平台，亦或是e-Textile Summer Camp 2017偏向藝術祭或是私立學校系統的作法，或是這些散落在世界各地的黑客、創客空間、營、自營社群所帶來的隱性價值。或許未來我們能做的是在這些獨立群體間引發一股如同發酵的跨國界、文化的聚合。

「蟲化世代臨時自治實驗室」由Hackteria組織，邀請國際研究人員，藝術家和企業家作為參與者。作為臨時建築的實驗室應允許生物學和工程學領域的研究人員與藝術家合作，從而在"兩種文化"，人文科學與藝術之間建立聯繫。參加者將以"蟲化"（wormolution）為主題，藉餵食蠟蟲PET使其產出含有生物塑膠特質的蟲繭此一特殊現象，探索作為我們社會豐富物質的塑膠與自然界中的新陳代謝和過程之間的聯繫。通過結合他們的專業知識，共享簡單的指令並進行批判性的和理論性的思考，藝術家和科學家將創造新的方式來組合多種生態，可能以循環方式，也可能以全新的自由和意識方式-Hackteria

Hackteria coordinates a Temporary Autonomous Laboratory, inviting international researchers, artists and entrepreneurs as participants. The lab as a temporary construction should allow researchers from the fields of biology and engineering to collaborate with artists and so create links between the "two cultures", the human sciences and the arts. On the topic of "Wormolution", by looking at the phenomenon that feeding PET to waxworms to force it produce bio-plastic cocoon, participants will explore the territory between plastic as the abundant material of our society and the natural metabolisms and processes in nature. By combining their expertise, share simple instructions and engaging in critical and theoretical reflections artists and scientists will create new ways to combine multiple ecologies, maybe in a circular, maybe in a whole new way of freedom and awareness.- Hackteria

Amateurs Powering The democratization of Science

In 2018, Tribal Against Machine was invited to Shenzhen Maker Faire to present one of the main speeches. I met one of the organizers, Marc Dusseiller, in a talk about Gathering for Open Hardware Science (GOSH). We both believe that Herschel and Smith's selfless sharing, cooperation with each other, and pure passion for each other's research had promoted the positive role of science in advancing human civilization. The founder of the open-source platform of biological art, Hackteria, Marc Dusseiller also endeavors to promote 're-democratiza-tion' of science, open-source culture in the contemporary era through workshops and international 'camps'. Citizen Science may sound new, but in fact has a century-old origin. The development of science originally relied on amateur scientists in the early 19th century. The word "amateur" in English can be traced back to the same French word "amateur" appearing in late 18th century which was explained with a Latin origin, "amatore", mean-ing love. Amateur means "a person driven by love, not by money", or "one who cultivates and participates (in something such as painting, science, music) but does not pursue it professionally or with an eye to gain." Another derogatory derivative, "dilettante" refers "a person having a superficial interest in an art or a branch of knowl-edge." By the 20th century, science began to be dominated by the technocrats of institutions or governments. From the 1970s, the voice for "re-democratization of science" started rising; science should return to the hands of amateur scientists rather than dominated by the money-biased technocracy.

"Bring it on the forum! Bring it on the forum!" came Marc's almost mechanical and obsessive-compulsive respons-es every time I popped up some of my random ideas. For example, when I want to use laser in fixating persimmon dye, or use silver conductive paste to make circuits on PDMS silicone, seemingly rush and rough, he always invites me to actively bring it onto the active and well-maintained online forum and wiki site of Hackteria for discussion. With the spirit of promoting open source, Marc always encourages everyone around him to actively share all crazy ideas with the hive mind on the forum as much as they can.

在蟲化世代—Hackteria臨時自治實驗室中，雷射染計劃嘗試將一段蠟蟲咬食塑膠的過程
音訊轉化成氰版圖像。
The Laser Dye Project tried to visualize a process of waxworms eating PET in
the Wormolution - Hackteria Temporary Autonomous Laboratory workshop.

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As the organizer of Tribe Against Machine, I admire that Marc has promoted the open source community and international collaboration between science and art for decades, in the not-for-profit fashion. Hackteria is not just an open-source biological art platform, but also a huge republican network connecting a variety of communities upholding the same spirit. Some describe Marc as a mushroom, who, in an organic and unpredictable fashion, disseminates these networks. In 2019, with Marc, I visited several his international partners and workshops, including LifePatch in Jogja, Indonesia, the Wormolution workshop in Geneva, the Gaudilabs laboratory in Luzern and several hacker spaces in Switzerland. I observed that as an organizer and cultural promoter, Marco gets along with people around him without hierarchical distance. He hardly sets up any specific control mechanism or pre-set goals in any of the workshops he organizes. There are no conventional presentation format, expected outputs, precise schedule of the workshop or regular group discussions during the workshop. He pays more attention to the latent, non-obvious communication in these processes. Artists and scientists are free to use their own customary paces to participate in the workshop.

To define or to innovate a production system is not a simple task. Take for example, the nomadic exploration of the Laser Dye Project, the open-source network of Hackteria, or festivals, private schools, and residency programs like the e-Textile Summer Camp in 2017, or these hackers, Maker spaces, camps, self-operated communities scattered around the world. Maybe what we can do is to find a way to build connections, like fermentation, to trigger cross-border, inter-cultural assemblage between these individual groups in the coming future.
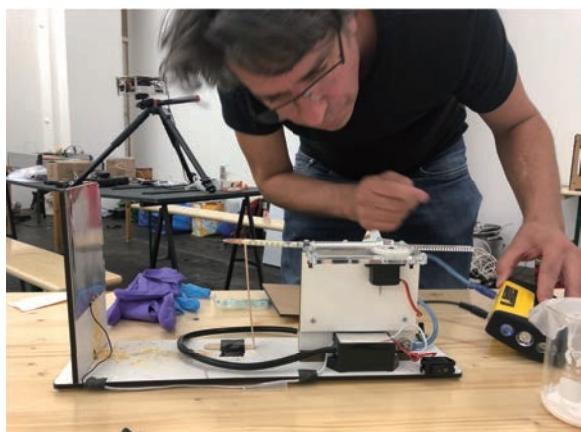
蟲化世代—Hackteria臨時自治實驗室的參與者之一，烏爾思·高登斯正在利用DIY的靜電紡紗裝置，製造工作坊中實驗需要的奈米纖維。該DIY組件由一個針筒、一塊金屬薄板電極、一個變壓器、一個Arduino和幾個雷射切割的齒輪組構成。

One of the participants of Wormolution - Hackteria Temporary Autonomous Laboratory, Urs Gaudenz was trying to produce nano-layers for the experiments in the workshop by a DIY electrospinning device. The DIY kit consists of a syringe, a metal sheet electrode, a transformer, an Arduino and several laser-cut tooth sets.

新氰版和同調性的光
New Cyanotype
And The Coherent Light
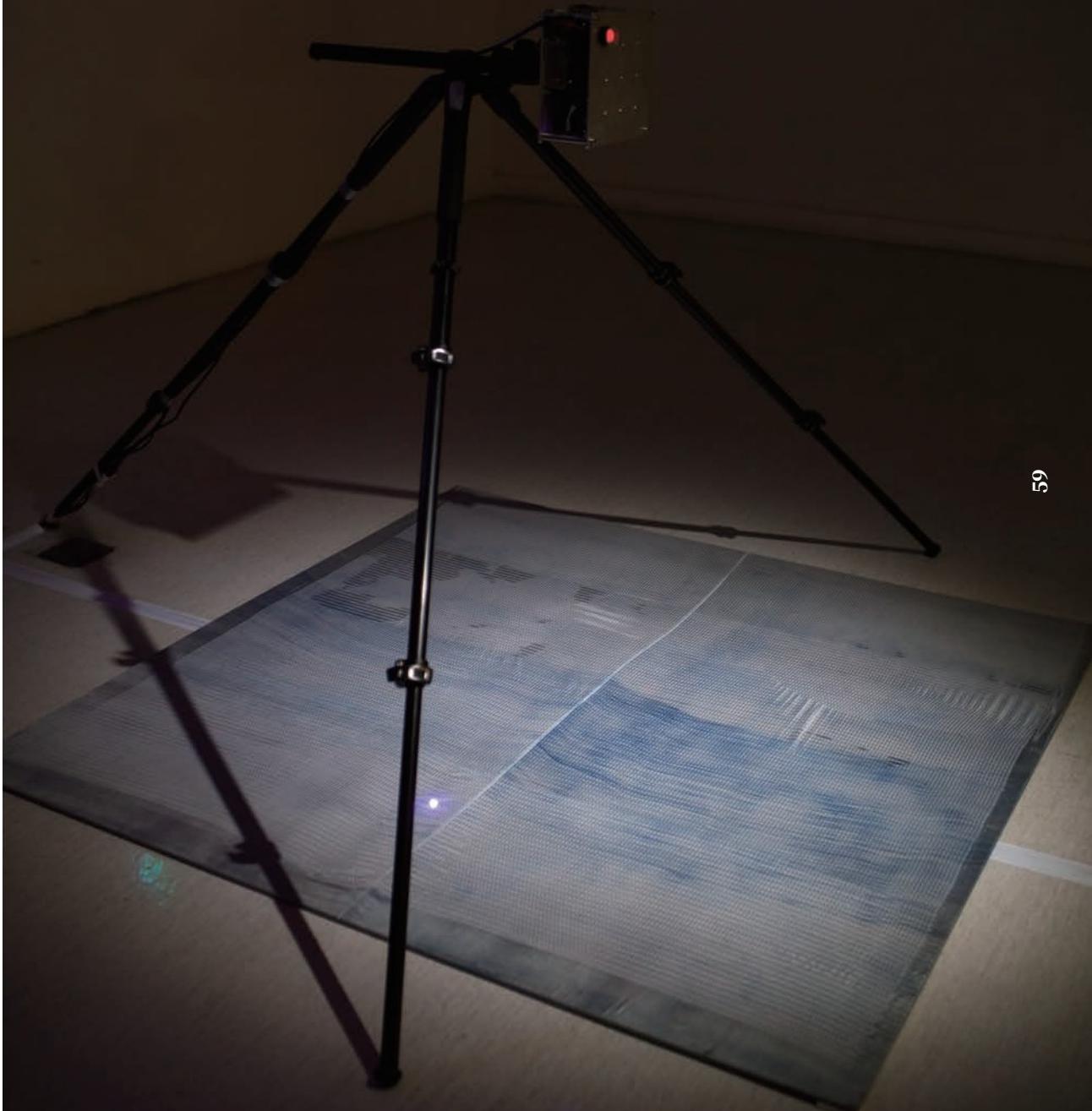
展場中重現雷射染印製環境的裝置，包括三腳架、DIY雷射
機、待印物、數位類比轉換卡、電腦。待印物塗佈由可重複感
光的感光油墨取代新氰版顯影液。

The Laser Dye printing environment was represent-
ed in the exhibition, including tripot, DIY laser
machine, printing object, DAC card, computer. The
coating of the printing object was
replaced from New Cyanotype to photochromic ink.

雷射染計劃

雷射染計劃是施惟捷於2015年開始發展的一個開源的實驗染色項目，並在顯影工藝、程式碼藝術和數位製造領域之間建立聯繫，直到這次和工藝中心合作，才開啟了和天然染料合作的初步實驗。雷射染計劃通過利用可編程的DIY雷射投影機和最古老的照相工藝「氰版顯影」，利用便宜的接近紫外線的405nm雷射光源，使被塗佈氰版感光液的織品部份曝光，在天然纖維上形成永久的、並可被數位編程的藍色圖像。由於省略了在原始顯影工藝步驟中使用負片作為成像遮罩的步驟，和利用雷射投影的特性，使其可以在不平整的待印物上進行曝光顯影，或是在脆弱且無法進行印刷的材質上如織品、刺繡、紙張、生物表面上製造具像且永久的藍色圖像。除了氰版顯影，作者亦曾使用了銀鹽類的凡戴克棕版顯影法和麥克威爾對舊氰版改良的新型氰版顯影(New Cyanotype)，藉以提升感光度、製造速度和色彩的層次性，但因為屬於銀鹽類的凡戴克棕版腐蝕性較強，故較少使用。也因為沒有負片步驟的關係，使成品面積不受負片面積限制，因此可以製作較大的成品，在展覽中亦呈現了兩幅3米平方的雷射染作品。這項計畫的初始靈感先是作者希望將和雷射同步的音像表演中的音頻視覺和譜視化，雷射的動作來自於振鏡的高頻率動作，透過將編程產生的類比信號傳送到振鏡上，就可以讓聽覺和雷射以幾乎沒有延遲的一起同步運動。為了將這個表演的過程記錄下來，因而開始尋找透過感光方式來記錄雷射動作軌跡。經過三年的研究後，演化成現在跨足服裝印花、傳統顯影工藝、科技藝術等領域的項目。
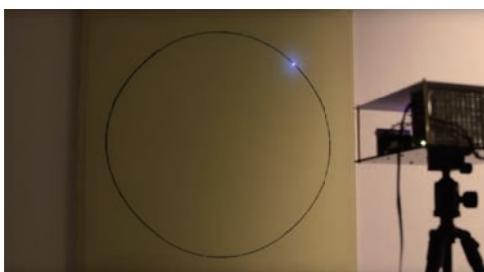
雷射染最早的表現形式，是在預塗佈好氰版的棉布上，用雷射曝光的方式製造一個圓形的圖像。該圖像是在程式環境Max/msp中預先產生一個像素圖片，然後再將像素圖片資料換算成雷射光點的移動速率，在作品上造成具有深淺顏色的曝光結果。

The earliest manifestation of Laser Dye was to create a circular image by laser exposure on a cotton canvas pre-coated with cyanotyope. The image was a pixel image generated in advance in the programing environment Max / msp, and then the pixel image data was converted into the velocity of the laser beam movement, resulting in an permannent blue image with intensity.

Laser Dye Project

Laser Dye Project is an open source experimental dye project launched by Shih, Wei-Chieh in 2015 to establish connections among image art, programming art and digital production. This collaboration with NTCRI kicks start the initial experiment with natural dyes. Using the programmable self-built laser projector and the oldest image craft, the cyanotype, by the 405nm laser source and the pre-coated cyanotype on textile, the Laser Dye Project aims to create everlasting, programmable blue images on nature fibres. Skipping the step of negatives as imaging masks, the laser projector is able to create everlasting images on uneven receptive surfaces and fragile materials that are not fit for traditional printing, such as textiles, embroidery, paper or living creatures. No negatives also means no size limit for final works. Two laser-dyed panels of three square meters were included in this exhibition. In addition to the traditional cyanotype, Vandyke Brown and New Cyanotype, an improved formula developed by Mike Ware are also employed in the Laser Dye Project, to enhance photosensitivity, production speed and color richness. However the Vandyke Brown is rarely used due to its high causticity. In the initial concept of this project, Shih tried to visualize and spectralize his audiovisual performances that are in synchronization with the laser projection. The action of the laser projector comes from high-frequency activities of the Galvanometer. By transmitting programmed analogue signals to the Galvanometer, sounds can work in synchronization to the laser without delay. In order to record this performing process, Shih started tapping into photosensitive methods to document the traces of the laser activities. After three years of research, the initial concept has evolved into a project involving printed costumes, traditional image art and technology art.

作者將早期的雷射音像作品譜視化是雷射染計劃的起源。

The author's intention to make physical notation scope for laser audiovisual work open up the development of Laser Dye project.

雷射染早期的原型之一：由Max/msp產生的雷射投影投射在運動中的人體上，再由一台數位單眼相機進行一分鐘長的曝光得到該影像。

One of the early prototypes for Laser Dye Project: This image was produced by projecting laser scanning graphic generated in Max/msp onto a person in motion. The process was captured by a digital monocular camera with 1 minute exposure.
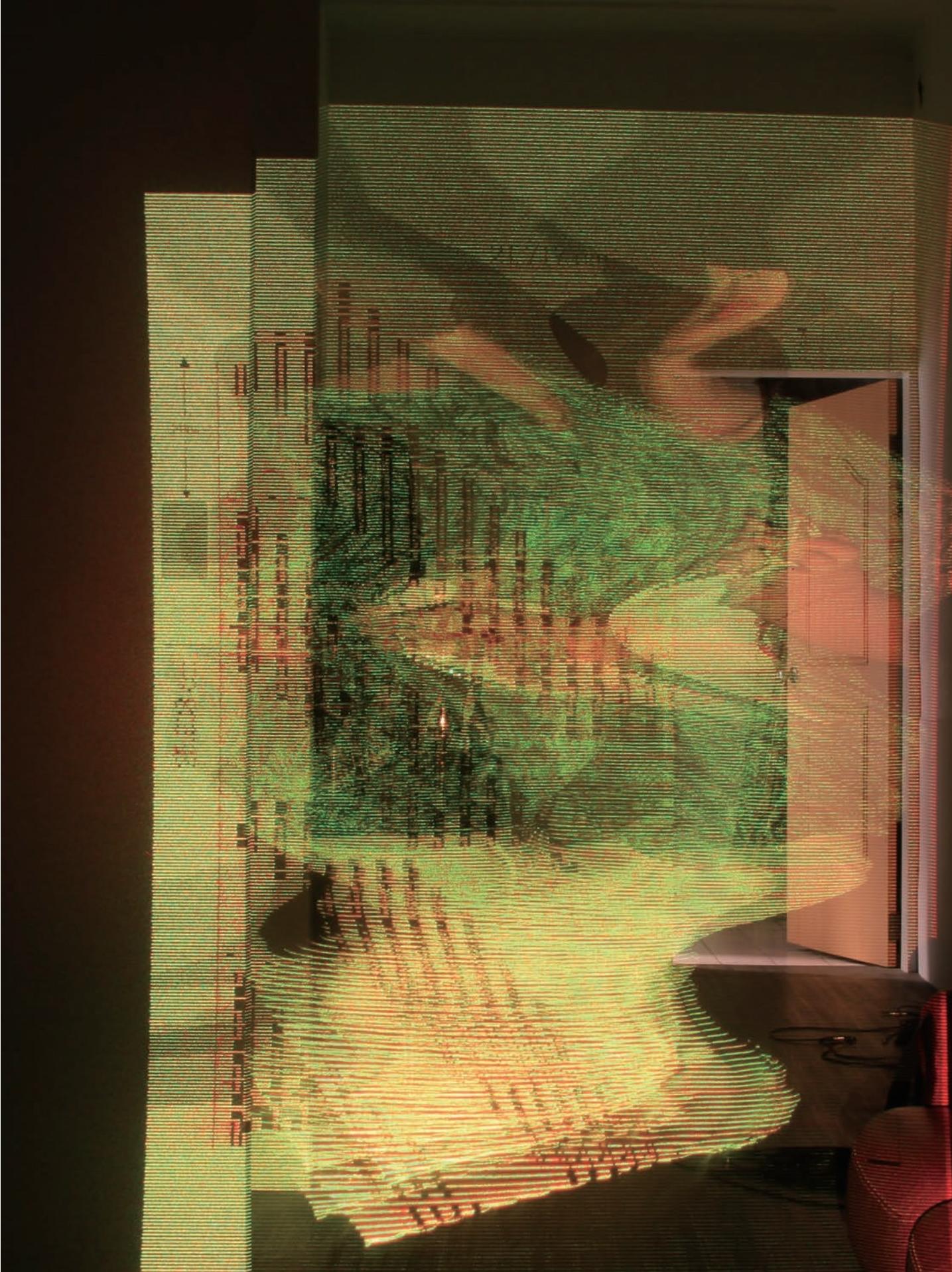
不定時出沒的條紋！

雷射是具有單調性的光，也就是單一波長，單色性好，相干性好的光源。使用具有高相干特性雷射作為顯影放相光源，時常造成一些疑似光學上的干涉條紋現象。在圖（a）中兩張織品中使用同樣數位檔案的雷射染作品，上面的一張呈現和數位檔一致的圖像，而下面一張的圖像中產生了類似干涉條紋的結果。雷射染的成像方式是使用單光點掃描在感光液上，並利用光點移動的速度來控制曝光時間的長短，以製造深淺。但是這些條紋和圖像深淺的部份並沒有一定的關係。另外這些條紋出現的時間和特定圖像沒有連結（兩次使用同一數位檔案的打印，卻只有一張呈現干涉條紋），所以並不能論定是雷射光點掃描的速差導致了這樣的條紋。

另一個條紋產生的可能性是來自擺設待印織品的方式，可能是織品塗佈感光液變濕後，在晾乾後所產生的皺摺在織品底部產生了空間，這些雷射穿過織品纖維後造成了漫射，然後這些漫射光再被織品底下的桌子或地板反射回來互相干涉而產生了這些條紋。亦或可能是這些塗佈後產生的皺紋導致了顯影液分布的不均，通常皺摺處會吸收比較多顯影液，導致這些部位顯影的速度比較快，最後產生了和皺摺相符合的條紋，但是在圖（b）棕版凡戴克作品上的橫向條紋顯然不是織品的皺摺所造成的，因此也排除了這個可能。僅於此記錄下在雷射染計劃中所產生的有趣現象。
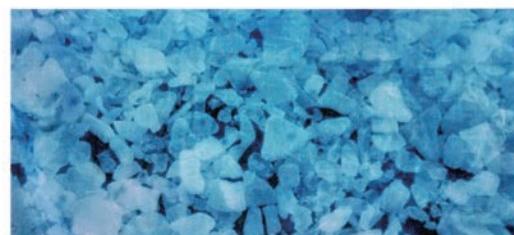
(a)

(b)

An Interesting Discovery: The Frindge!

Laser is a light with monotonicity, that is, a single wavelength, good monochromaticity and good coherence. The fringes, likely an optical result, is often found in the Laser Dye Project: Picture (a) shows two New Cyanotype pieces exposed by laser scanning with the same digital file. The upper one appears the same with the digital file, while the fringes appear in the lower one. The imaging method of Laser Dye Project is to create greyscale by altering the scanning rate of the laser dots movement, to apply different exposure level to the textile pre-coated with sensitizer. However, these fringes seem have no certain relationship with the grayscale of the image. In addition, these fringes are not bond to the digital file (two prints created from the same digital file, but only one shows the fringes), so we are not able to conclude that the fringes are from the varying speed of the laser scanning.

The other possibility how these fringes are created might relate to how the textile was placed under the laser machine. After the textile was coated and dried, the wrinkles created space between the textile and table, the laser goes through the textile fibre and the scattering is created. Then the scattered laser bounces back and create interferences and it is documented by the textile as fringes. Or it is the wrinkled area of the fabric absorbs more sensitizer than the other area and causes more exposure in these area, thus it appears darker. However, the fringes on the Van Dyke brown piece doesn't shows any relation to the fabric wrinkle. I hereby document this interesting phenomenon in Laser Dye Project.

雷射染製備過程（新氰版）

Laser Dye Process

(with New Cyanotype)

實驗準備：
草酸鐵銨 (NH4)3[Fe(C2O4)3].3H2O：30克
鐵氰化鉀：10克
檸檬酸結晶：40克
蒸餾水：200毫升
任何天然纖維織品，由於織品吸入過多顯影液會導致
預期外的顯影污點，請以輕薄、布重輕的織品為佳！

The Preparation:
Ammonium Iron(III) Oxalate：30 g
Potassium Ferricyanide K3[Fe(CN)6]：10 g
Citric acid crystals: 40 g
Distilled water to make：200 cc
Any nature fibre textile is workable, but too
much sensitizer absorbed by thick fabric will
lead unwanted stains in the drying step,
please pick thin fabric for the best restult!

A劑：20毫升蒸餾水加熱到攝氏
70度。
A: Heat up 20 cc distilled
water to 70 ºC.

B劑：30毫升蒸餾水加熱到攝氏
50度。
B: Heat up 30 cc of A: distilled
water to 50 ºC.

A劑：加入10克鐵氰化鉀並攪拌
到完全溶解。
A: dissolve 30 grams of
potassium ferricyanide in it.

B劑：加入30克草酸鐵銨並攪拌
到完全溶解。
B: dissolve 30 grams of
Ammonium Iron(III)
Oxalate in it.

混合A、B二劑攪拌均勻後置於
黑暗處等待其降至室溫避光2
小時。
Mixing up the A and B
solutions together and set it
aside in a dark place to cool to
room temperature and wait for
about 2 hours.

將草酸鐵鉀結晶自顯影液中濾
出，再將顯影液放入避光瓶收
藏，結晶亦收藏於避光處。
The potassium ferrioxalate
crystals from the sensitizer.
Store the sensitizer solution
in a dark bottle. Store the
crystals in dark place too.

將儲存好的顯影液和40~140克的蒸餾水混合以製造工作顯影液，蒸餾水比例越高感光性越好，藍色彩度越低。
Mixing up the sensitizer with 40 to 140 grams of dispilled water, the more the dispilled water the more light sensitive it will be, the less bluish it will be.

在混合好的工作顯影液中滴入40%濃度的檸檬酸溶液。比例是每一毫升顯影液對1滴檸檬酸溶液。
Add 40% citric acid solution to the mixed sensitizer. The portion is every ml of sensitizer to one drop of citric acid solution.

取適量的工作顯影液將已經精練過的織物染漬，並盡量擰乾。也可以用新的水彩筆來塗佈。
Take appropriate quantity of the working sensitizer to dye the fabric, and wring it out as much as possible. The coating can also be done by water color brush.
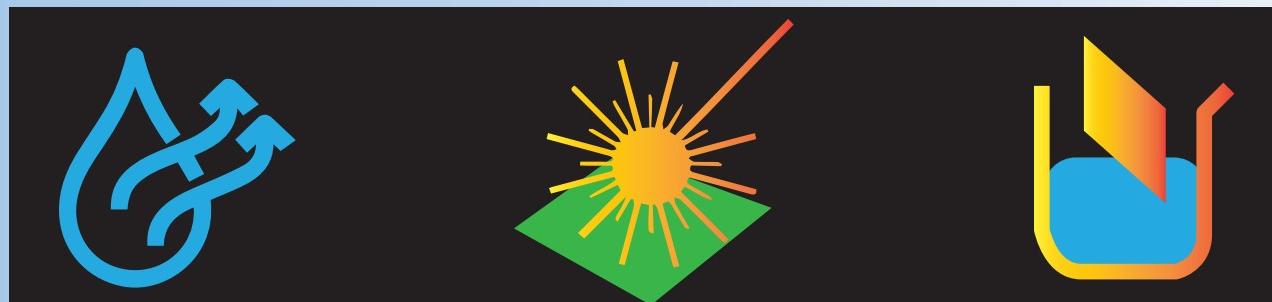
將塗佈好的織品置於全暗處晾乾，這個過程可以用熱吹風機加速，但注意吹風機不可以太接近織品或是長時間停在某處。
Place and dry the coated textile in a dark place. This process can be accelerated by heat fan, but notice do not put the fan too near the textile or stay in one place for long time.

將完全乾燥後的織物置於雷射機下，或是攤平掛於牆上並開始打印。
Place the completely dried textile under the laser machine or hang it flat on the wall and start to print.

將打印完成的雷射染織物先放進濃度5%的檸檬酸溶液中浸泡一分鐘，再完全以自來水沖去殘餘在織物上的藥劑，或是直接機洗。
Put the laser dyed textile into the 5% citric acid solution for 1 minute to remove the leftover solution in it completly, or just put it into the washing machine.

通訊協定
The Protocal

ILDA（International Laser Display Assosiation）是控制雷射投影機所使用的國際通用通訊協定，硬體上使用有25個針腳的D-sup電腦排插頭，只要對這25個腳位輸入適當的電壓，就可以控制雷射機製造任何的雷射圖案。雷射投影機由振鏡模組、反射鏡和雷射光源組成。藉由兩個在x、y軸上高速左右擺動的鏡子反射出雷射光，就可以在投影面上形成二維的圖像。雷射染計劃使用Cycling74公司開發的圖像介面（GUI）程式環境—Max/msp，將二維的像素圖片換算成電壓，透過一段數位類比轉換的過程，將這些自圖像轉換而成的電壓信號送到雷射機端的ILDA接口，使我們能在塗佈好顯影液的待印織物上以掃描的方式投影雷射圖像，再透過氰版顯影曝光的原理產生圖案。

ILDA (International Laser Display Assosiation) is an international protocol for controlling laser projectors. The hardware uses a 25-pin D-sub plug. We can create any laser graphic by sending appropriate signals in analog voltages to those 25 pins. By shooting the laser beam in-between two mirrors vibrate left and right at high speed on the x and y axes, a two-dimensional image can be formed on the projection surface. The Laser Dye Project uses Max / msp, a GUI programming language developed by Cycling 74 to decode digital images into analog voltages. Through a digital signal process, these voltage signals are sent to the laser machine to the ILDA plug at the back of the machine, enable us to project the laser beam in a scanning manner to the textile which is pre-coated with photosensitizer, to produce the image by the principle of cyanotype photography exposure.

一般舞台燈光使用的雷射機器，都配有ILDA的訊號輸入口。

The conventional laser projectors for stage lighting all equipped with ILDA interface.

目前在雷射染色中使用用的DIY雷射機，含有雷射振鏡模組、雷射光源、電源變壓器等基本元件。

The DIY laser machine currently used in Laser Dye Project, contains basic parts including galvanometers modules, laser source, power adaptors.
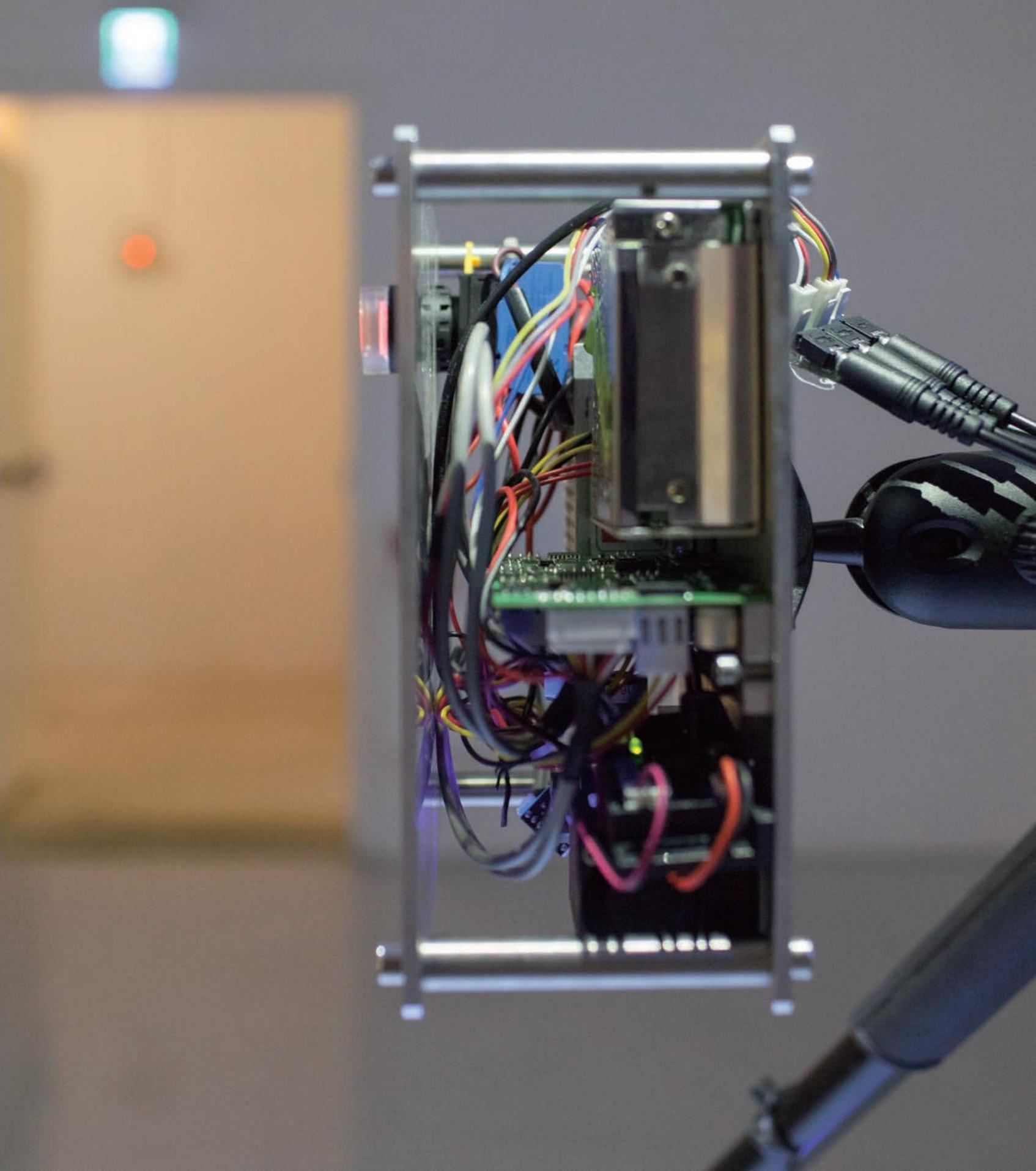
雷射染在夾克上打印的圖像表現，服裝設計：陳翊羽。

Laser Dye printed jacket, garment design: Chen Yiyu.
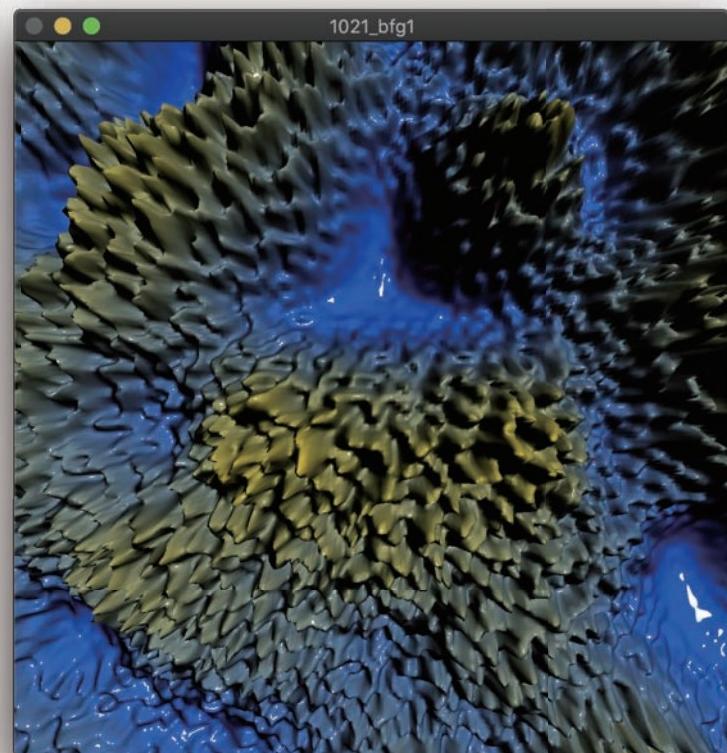
雷射染計劃中所使用的印花生成器，以Max/msp編寫，這個程式生成具隨機形狀的像素圖片，再將其轉換成向量資料，最後再將向量資料中每個點的x、y座標換算成兩個類比電壓，再送入到雷射機上的ILDA接口。

The interface of the textile pattern generator is written in Max/msp. This patch converts a generative pixel image into vector datas, then the x, y coordinates of each point is converted into two analog signals and then it is sent to the ILDA port on the laser machine.

Max程式載點 max patch download link: https://gitlab.com/greenhouseinfo/laser-dye

Max/msp

| cycle~ 440 | cycle~ 220 | cycle~ 1 | cycle~ 1 | cycle~ 1 |

x　　　　y　　　　R　　　　G　　　　B

數位類比轉換器(聲卡)/ DAC card

1　2　5　6　20
14　15　18　19　7
25　25　25　25　25

TSP/d-sub DIY轉接版 / adaptor board

1　2　3　4　5　6　7　8　9　10　11　12　13
14　15　16　17　18　19　20　21　22　23　24　25
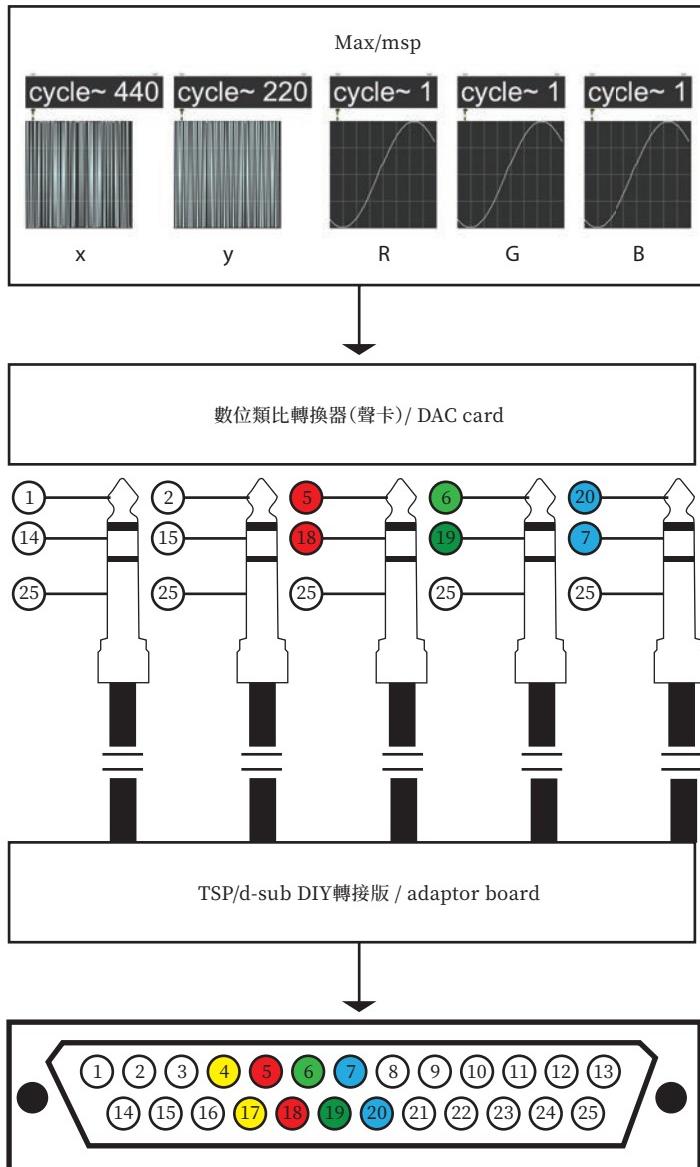
雷射染控制系統示意圖

雷射染計劃使用Max/msp程式環境、MOTU聲卡來製造這個DIY雷射控制系統。這還不算的上是最便宜的作法，但已經可以使你自由的製造任何的雷射動畫或路徑。這個做法是先由電腦端的Max/msp中生成5個波型，分別控制雷射圖形的X、Y軸和三個R、G、B雷射光源。

在電腦之後需要通過數位類比轉換器(DAC聲卡)，將數位的虛擬波形轉換為類比的電壓訊號。在這個步驟選擇了MOTU　mk4聲卡做為數位類比轉換器，產生雷射機所需要的五個立體音訊號，也就是在-5到5伏特震盪的五個差分信號。由於MOTU的輸出介面使用6.3　TRS音源信號頭，所以我們使用音源線做為我們的信號傳輸線。

透過一個自己DIY製作的訊號轉接板，將TRS音源頭轉接到雷射機後面的D-sub25針腳的電腦排插頭上，完成從電腦傳送訊號到雷射機的任務。　注意需要將4號和17號孔位短路，迫使雷射機從自動播放模式切換到接受外來信號控制。

Diagram of controlling system in Laser Dye Project

We use Max/msp coding environment, MOTU sound card to build our own laser system. This is not the cheapest way to do but it enables you to create any kind of laser animation or laser path on the fly. In the max, there are 5 waves are generated. It is for controlling x, y axis of the laser graphic and the R, G, B laser sources.

A DAC card (digital analog converter) is needed to convert the virtual signals generated from the computer to the analog signals in the real world. We chose MOTU mk4 sound card to generate the compatible voltage for the laser machine, which is vibrate from -5 to 5v. Because the output interface of MOTU is 6.3 TRS, therefore we use 5 conventional audio cables for the signalings.

Through a converter board to covert the TRS audio interface to the D-sub 25 pins plug at the back of the laser machine, to complete the mission to conduct signals being sent from the computer. Remember to shortcircuit the #4 and #17 pins to force the laser machine switches from auto-play mode to receiving mode and can be controlled by external signals.
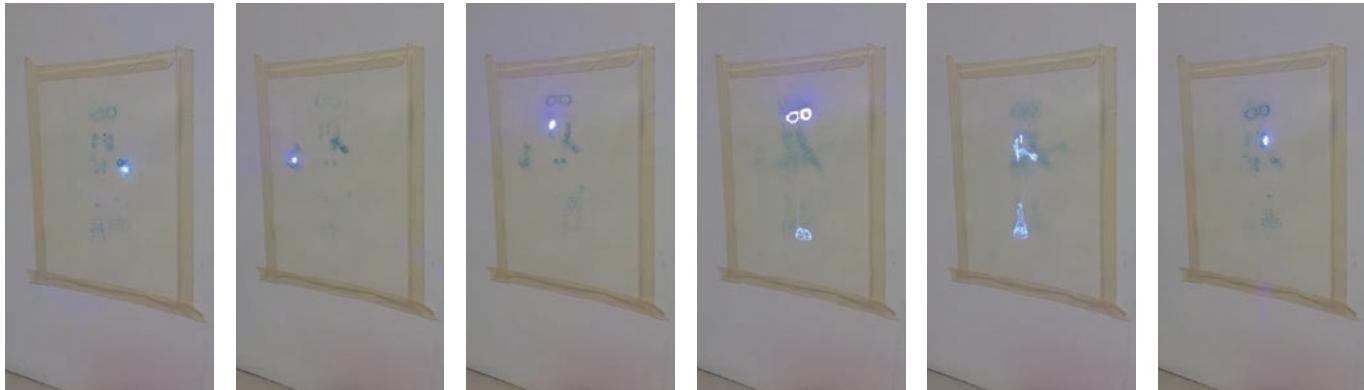
2015年作者在工作室對一塊塗佈了光致變色絹印染料的水彩紙投射一個由雷射構成的動畫投影，並在其上產生和氰版不同的可逆的感光反應，被雷射曝射的部份由白色變為藍色，經過約15秒又完全變回白色。

In 2015, in the studio, Shih Wei Chieh projected an laser animation on a piece of watercolor paper coated with photochromic ink, and produced a reversible photosensitive reaction different from the cyanotype process. The part exposed under the laser projection changes from white to blue, and after about 15 seconds it completely changes back to white.

破解雷射機ILDA介面使用到的第一個DIY轉接板。

由於早期作者雷射音像作品中使用的聲卡只能產生0到3伏特左右的訊號，因此需要透過訊號放大、電壓位移兩個動作來製造符合ILDA通訊協定所需要的訊號。作者使用三個運算放大器晶片來達到這個目的。但後來使用的MOTU聲卡能直接產生約-4.8到4.8伏特的訊號，故已不用再需要此放大調頻過程。

The DAC card was employed in the early audiovisual works only generate 0 to 3 volts audio signals, therefore the amplification and voltage offset is needed to generate the proper signals for the ILDA protocol. But the MOTU DAC card which is used in the current project generate around -4.8 to 4.8 volts, therefore the op-amp chips on the adaptor board are no longer needed.

有機與無機的原型們
The Prototypes of Organic and Inorganic

這場展覽中包含一些非正規做法的小實驗：由於新氰版已經含有鐵離子成份，因此混合新氰版和天然染時沒有加入媒染劑處理，但染出來的顏色也和傳統流程所製造的色澤不完全相同。在加溫過程中新氰版圖樣在約70度時開始明顯褪色，褪色現象隨持溫時間越長越嚴重；若此時覆染五倍子，圖樣會重新顯現，呈現灰褐色或紫褐色。其中一片新氰版作品在還沒有任何脫色現象時即放入加熱過的五倍子染液中，發現其圖案短時間即轉為深黑褐色，在之後的染程中即使加溫時間很長也沒有脫色跡象。在傳統氰版調色法中，利用紅茶或紅酒中的高單寧可將漂白過的氰版作品重新調色，顏色介於紅棕到黑褐色之間，因此推測具高單寧的天然染料都和紅茶一樣，之於氰版圖案同樣具有調色功能。

Some rapid experiments are documented in this exhibition: Because of the New Cyanotype technique, printed textile contains metal ion, therefore the conventional mordant was not added when we mixed the New Cyanotype in the natural dyeing process. During the heating process, we found that the New Cyanotype image faded greatly at about 70 degrees Celsius in the heating process, and the fading continued as the temperature was maintained longer, then the image would be restored significantly after being putting in the heated Chinese gallnut dye liquor. The restored pattern appeared grayish brown or purple brown. There was one unbleached New Cyanotype textile added to the heated Chinese gallnut dye liquor, which caused the pattern to turn dark brown immediately, and the fading didn't happen again in the long heating process. The high tannin contained in black tea or red wine are often used to tone bleached cyanotype works to change its color from blue to reddish brown or dark brown, therefore it is speculated that the natural dyes that contain high amounts of tannins could serve the same toning purpose.

染液萃取
Dye Liquor Preparations

栀子染液 / 被染物
＝ 50 g : 50 g
取50公克乾栀子，置於5公升水中浸泡一小時後再開始邊攪拌邊加溫，加溫至水滾即將栀子濾出五公升染液，重複此步驟得到十公升染液。第三次水滾後轉小火、持續攪拌並持溫三十分鐘得到5公升染液，總共15公升。先留下1公升染液以備覆染時加入。

五倍子染液 / 被染物
＝ 15 g : 45 g
取15公克五倍子，置於5公升水中浸泡一小時後開始邊攪拌邊加溫，每次水滾皆轉為小火、持溫30分鐘，在萃取染液的過程中觀察到萃取到第三次時，染液的顏色明顯變深色。最後取得共15公升五倍子染液，先留下1公升染液以備覆染時加入。

鱧腸染液 / 被染物
＝ 100 g : 50 g
取100公克曬乾的鱧腸（含有葉和較細的莖），剪碎後置於5公升水中浸泡一小時再開始邊攪拌邊加溫，水滾後轉小火持溫30分鐘並持續攪拌、時間到後將鱧腸濾出，重複二次後取得10公升染液，先留下1公升染液以備覆染時加入。

茜草染液 / 被染物
＝ 20 g: 60 g
取20公克乾的茜草，浸泡於3公升水中一小時，開火加熱至水滾後轉成小火，持溫20分鐘，將茜草濾出後再加入3公升清水，重複以上步驟。最後取得6公升茜草染液，先留下500毫升以備覆染時加入。

Gardenia fruit / textile
= 50 g : 50 g
Take 50 grams of dried gardenia fruit, soak it in 5 liters of water for one hour, and then start to heat while stirring. The first two times are heated until the water roll is about to filter out the gardenia fruit. After the third water roll, turn to a small fire and continue to stir Keep it warm for thirty minutes. After three extractions, a total of 15 liters of dye liquor is obtained, leaving 1 liter of dye liquor to be added for over-dyeing.

Chinese gull / textile
= 15 g : 45 g
Take 15 grams of gallnut, soak it in 5 liters of water for one hour, and then start to heat while stirring. Each time the water rolls, it is turned to a low fire and held for 30 minutes. During the extraction of the dye solution, the third extraction is observed. At that time, the color of the dyeing solution becomes darker. Finally, a total of 15 liters of gallnut dyeing liquid was obtained, and 1 liter of dyeing liquid was left to be added for over-dyeing.

Eclipta prostrata / textile
= 100 g : 50 g
Take 100 grams of dried snake-head (containing leaves and thin stems), shred it and place it in 5 liters of water for one hour, then start to heat while stirring. After the water rolls, turn to a low fire and keep it warm for 30 minutes and continue to stir After the time is up, the intestine will be filtered out. After repeating twice, 10 liters of dyeing solution will be obtained, leaving 1 liter of dyeing solution to be added when overstaining.

Madder / textile
= 20 g : 60 g
Take 20 grams of dried madder, soak it in 3 liters of water for one hour, heat it to a boil and turn it into a small fire, hold it for 20 minutes. After filtering the madder, add 3 liters of water and repeat the above steps. Finally, 6 liters of madder dye solution was obtained, and 500 ml was left to be added for over-dyeing.

被染物總重50克：雪紡蠶絲布45克、其它小片樣品布重5克。雪紡蠶絲布於天然染色前，先進行新氫版顯影染。

70 °C

降溫靜置冷卻的過程中每5至10分鐘需翻動布料，至約40度時將布料取出擰乾，以清水洗去多餘染液。

Give stiring to it every 5 to 10 minutes during the cooling until it reaches 40 °C. Take the textile out and wring it, wash the dye away with tape water.

轉為小火並持溫30分鐘後再關火冷卻。

Turn the fire to the minimum for 30 minutes then turn off the fire and cool it.

40 °C

將被染物浸泡於常溫的梔子染液中，以中火加溫至約攝氏70度，持溫約30分鐘。

Put the New Cyanotype textile into a pot of the gardenia fruit dye in room temperature, heat it up to 70 °C and hold the temperature for 30 minutes.

50 °C～60 °C
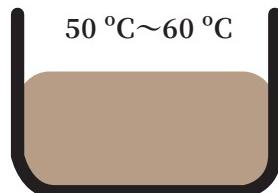
將被染物置於約50～60度的五倍子染液中，以小火加熱10分鐘，觀察到有雷射染的圖案部分顏色短時間明顯變深，關火並待其降溫至50度取出、清水漂洗。

Put the textile into the Chinese gallnut dye, heat it with minimun fire for 10 minutes. The cyanotype graphics will become darker in a short time. Turn the fire off and take the textile out at 50 °C, wash the dye off with tape water.

重複第一次染程，但持溫時間加長至40分鐘。

Repeat the first step but increase the heating duration to 40 minutes.

將被染物置於稀釋的常溫五倍子染液中，並以中火加熱至約攝氏70度，歷時約二十分鐘。轉為小火並持溫10分鐘，關火後直至冷卻至常溫，取出後以清水漂洗。

Put the textile into dilluted Chinese gallnut dye in room temperature and heat it up to 70 °C with stiring in around 20 minutes. Turn the fire off and cool it to room temperature. Take the textile out, wash the dye off with tape water.
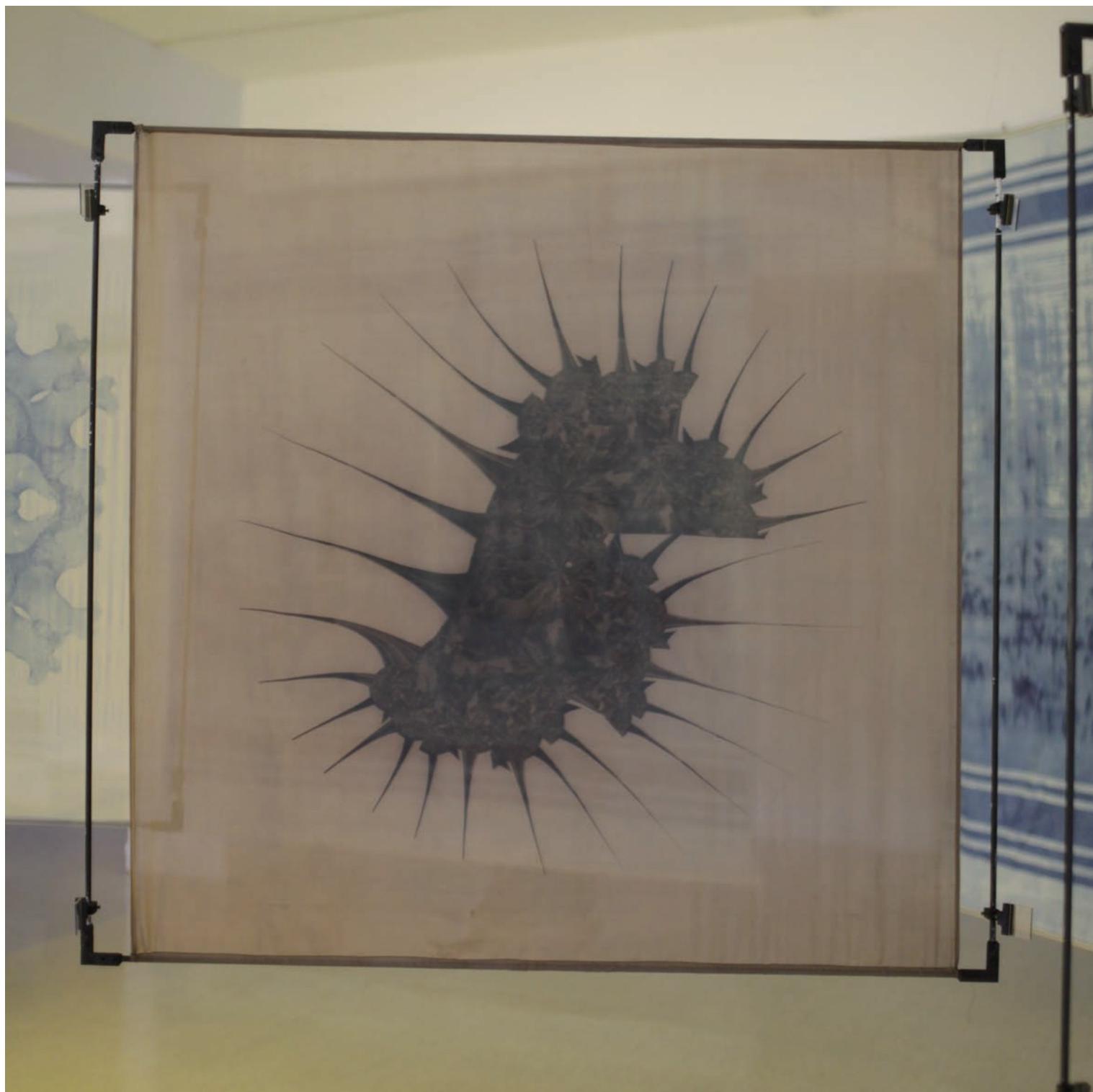
被染物總重50克：雪紡蠶絲布45克、其它小片樣品布重5克。
雪紡蠶絲布於天然染色前，先進行新氫版顯影染。

50 ºC
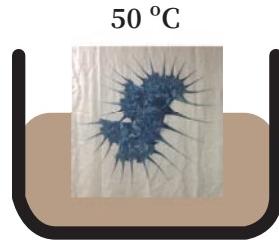
將被染物置於約50度的五倍子染液中15分鐘，過程中觀察到氰版圖案快速加深顏色。關火直到降溫至約40度時取出，以清水漂洗。

Put the textile in the Chinese gallnut dye in 50 ºC for 15 minutes. The cyanotype graphic will get darker significantly. Turn off the fire and cool it till 40 ºC. Take the textile out and wash it with tape water.

70 ºC
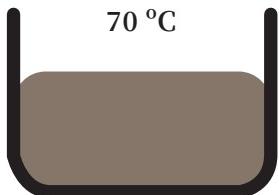
將被染物置於常溫鱧腸染液中，以中火加熱至約攝氏70度，歷時約20分鐘。調整至小火後持溫30分鐘，降溫至常溫後以清水漂洗。

Put the textile in Eclipta prostrata dye and heat it up to 70 ºC with medium fire in 20 minutes. Turn the fire to minimal and hold the temperature for 30 minutes. Take the textile out and wash it with tape water.

70 ºC
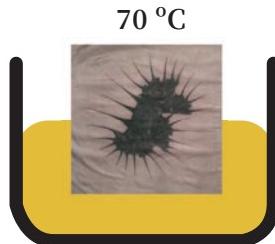
將被染物浸泡於常溫的梔子染液中，以中火加溫至約攝氏70度，歷時約三十鐘，到達70度後轉為小火並持溫40分鐘後關火，以清水漂洗。

Put the textile into gardenia fruit dye in room temperature and heat it up to 70 ºC in 30 minutes. Turn the fire to minimum and hold it for 40 minutes. Take the textile out and wash it with tape water.

50 ºC～60 ºC

被染物置於常溫茜草染液，以中小火加熱至約攝氏70度，溫度到達後轉為小火並持溫30分鐘之後關火，待其降至常溫後取出以清水漂洗。

Put the textile to mader dye liquor in room temperature, heat it up and turn off the fire at 70 ºC. Turn the fire to minimum and hold the temperature for 30 minutes. Cool it to room temperature and take the textile out and wash it with tape water.

同第四次染程，唯持溫時間拉長至60分。

Repeat the 4th steps but extand the holding temperature duration.

雷射染、梔子、泰絲
laser dye, gardenia fruit, habotai

雷射染、紅茶、藍染
laser dye, black tea, indigo dye

藍染、雷射染、泰絲
indigo dye, laser dye, habotai

紫草、雷射染、雪紡紗
gromwell, laser dye, chiffon

雷射染、茜草、雪紡絲
laser dye, rubia cordifolia, chiffon

藍染、雷射染、紅茶染、棉
indigo dye, laser dye, black tea dye, cotton

雷射染、鱧腸、泰絲
laser dye, eclipta prostrata, habotai

雷射染、五倍子、絲棉
laser dye, Chinese gullnut, silk cotton
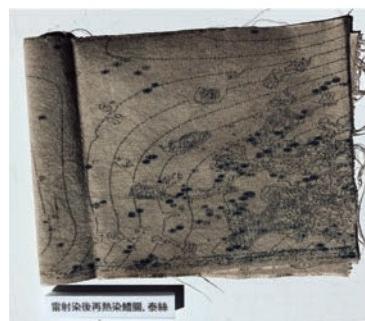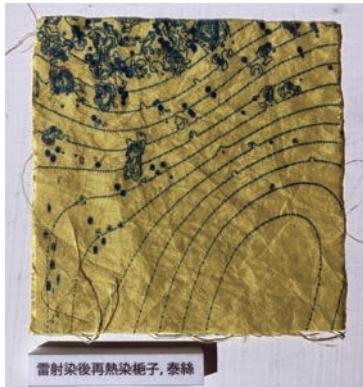
原型名稱依染序排列

Prototype names are arranged in order of dyeing

藍染（絞染）、雷射染、紅茶染、棉
tie die with indigo dye, laser dye, black tea dye, cotton

雷射染、五倍子、鱧腸、棉布、生絲
laser dye, eclipta prostrata, Chinese gallnut,
cotton, raw silk

雷射染、構樹皮
laser dye, paper mulberry

福木、雷射染、烏干紗
Fukugi tree, laser dye, organza

雷射染、鳳梨纖維
laser dye, pineapple fibre

雷射染、藍染、泰絲
laser dye, indigo dye, habotai

原型名稱依染序排列

Prototype names are arranged in order of dyeing

雷射染、薯榔、棉
laser dyed, shoulang yam, cotton

雷射染、棉
laser dye, cotton

刺繡、雷射染、棉
pre-embroidered cotton fabric, laser dye

草酸鐵鉀水晶圓盤模型
Potessium ferrioxalate crystal in patri-dish

草酸鐵鉀水晶在苎麻上
Potessium ferrioxalate on ramie textile

原型名稱依染序排列
Prototype names are arranged in order of dyeing
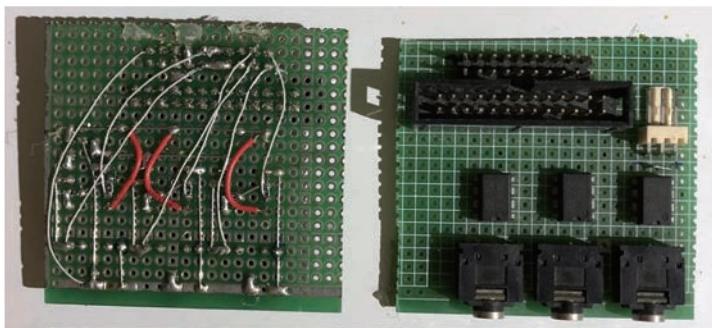
ILDA 雷射機轉接板 #1
ILDA adaptor board #1
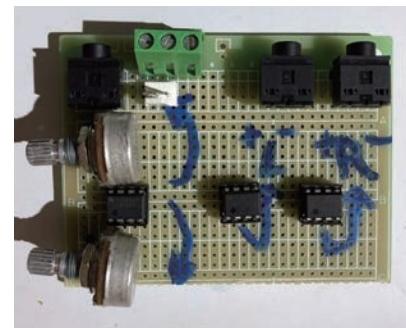
ILDA 雷射機轉接板 #2
ILDA adaptor board #2

ILDA 雷射機轉接板 #3
ILDA adaptor board #3
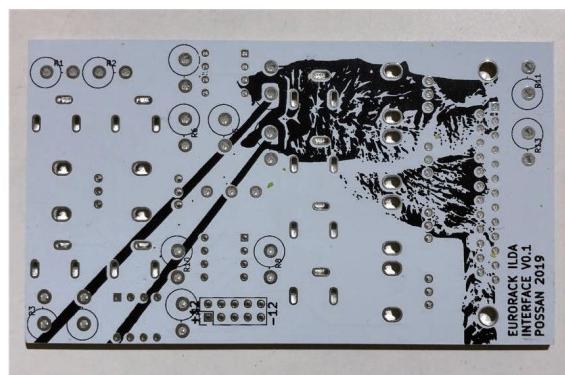
ILDA 雷射機轉接板 #4
ILDA adaptor board #4
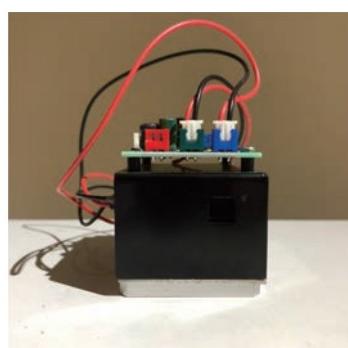
405nm雷射雙光源模組
Duo 405nm laser module
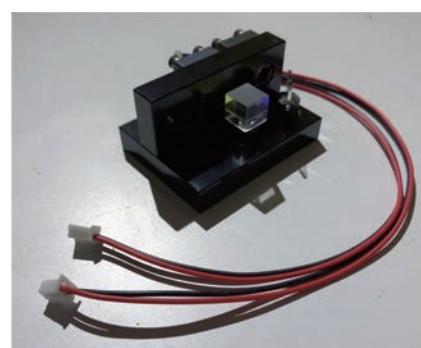
雙405nm雷射光源模組內部
Inner structure of duo 405nm laser module

雷射染計劃中的DIY雷射ILDA轉接板和雷射光源
ILDA adaptor boards, laser sources used in Laser Dye Project

花 The Textile Printings
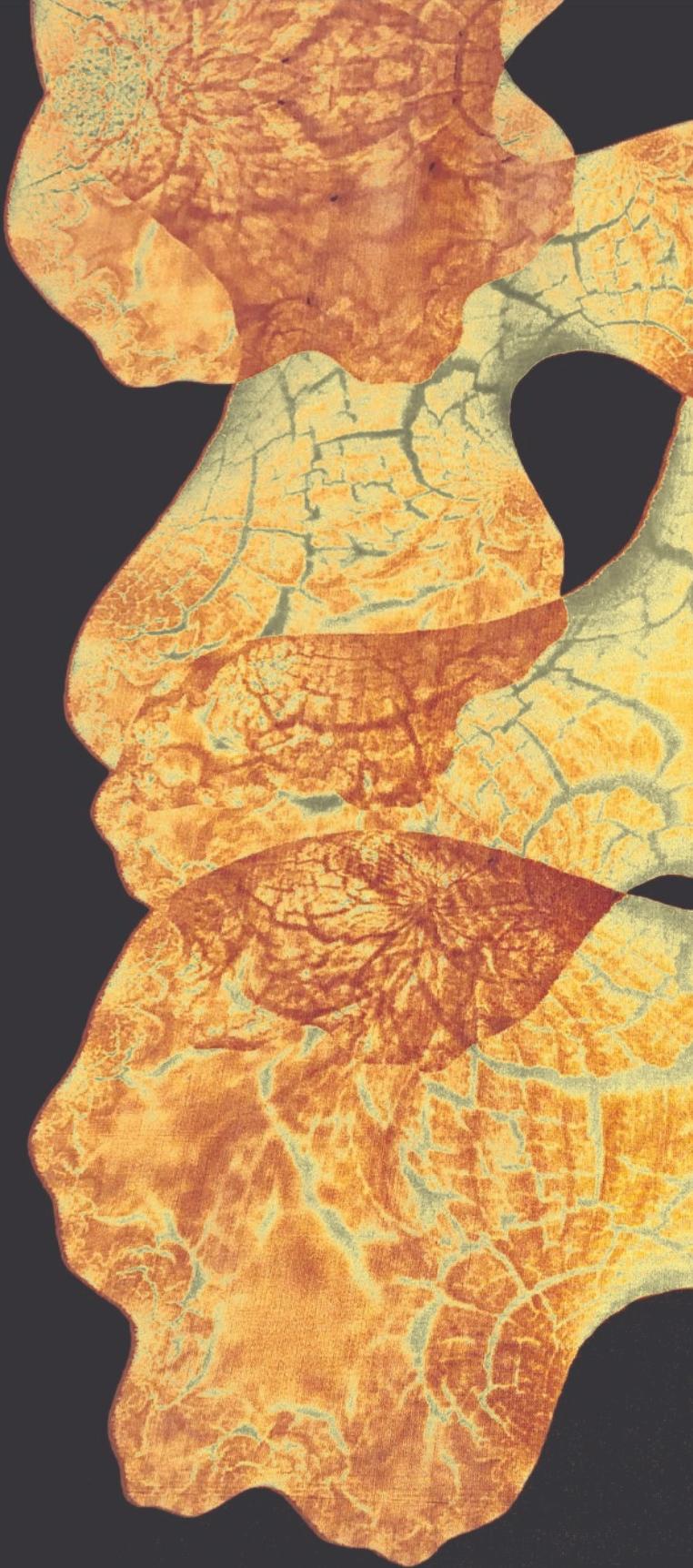
棉、新氰版顯影
cotton, New Cyanotype
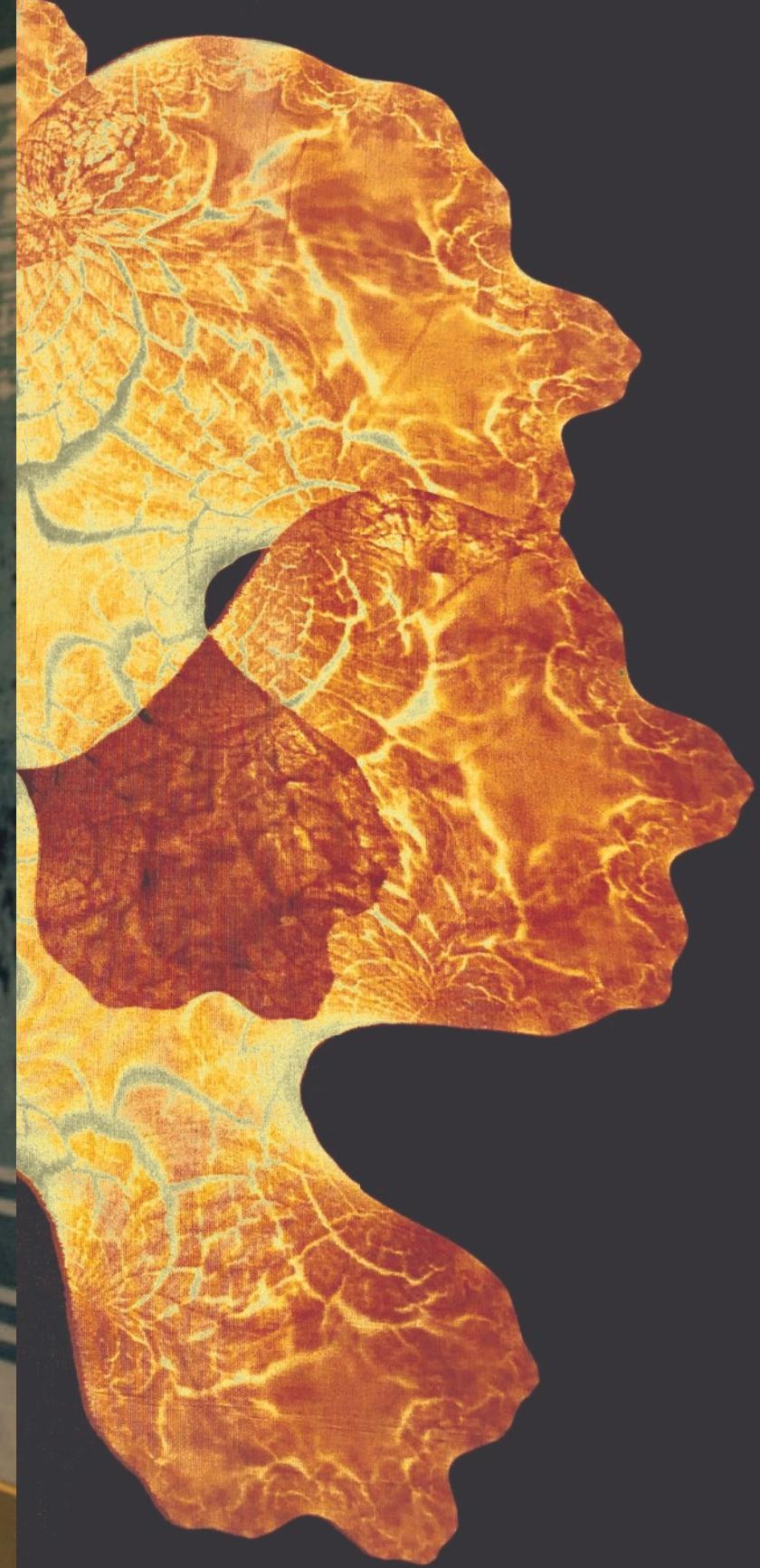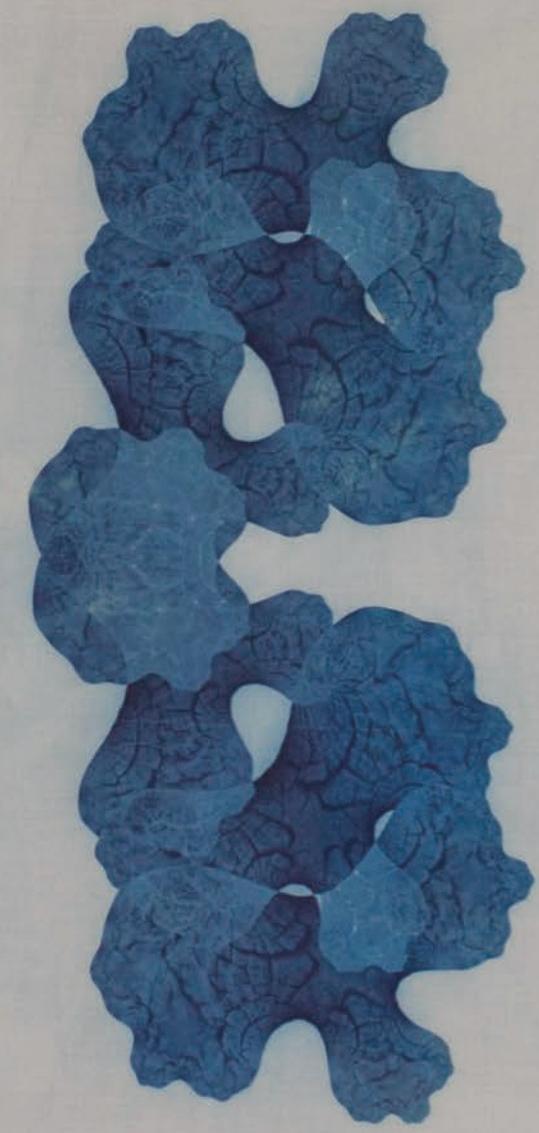
絲、新氰版顯影

silk, New Cyanotype

展覽中的印花數位檔案是在Max/msp軟體中生成，以碎形概念為演算法，先將基礎的3D模型如圓球、立方體碎型化，再貼以草酸鐵鉀的圖片做為質感，最後再使用萬花筒濾鏡進行對稱化。這些圖案最後再被轉化為雷射染投影，在每張110 x 110公分上的織品上進行氰版顯影的曝光。

絲、新氰版顯影

silk, New Cyanotype

The printed digital files in the exhibition are generated in Max / msp software, using the concept of fragmentation as the algorithm, first the basic 3D models such as spheres and cubes are fragmented, and then the pictures of potassium iron oxalate are used as the texture. Finally, use a kaleidoscope filter for symmetry. These patterns were finally converted into laser-dye projections, which were exposed to cyan plate development on each 110 x 110 cm fabric.

如果時間是穿戴且折疊的

If Time Was Wearable and Foldable

陳翊羽・服裝設計師

從開始接觸天然染、手織到參與雷射染計畫，我對於設計的方法和想法也有很多改變。在接觸和執行了染色及初始材質處理的過程中，因為這些手工過程相對於直接使用大量生產的材料有更多在技術未臻熟練前不可掌握的因子，剛開始的成品總是難以達到預想中的效果或難以預測每個階段的產出品質。對比於過去使用熟悉的材料（工業生產的布料）和傳統服裝製作技術的設計過程，使用這些天然纖維、小量手工染色，會迫使我採取較開放的設計流程和對不可控成果的包容性。這當中包括從構想設計、打版和處理服裝縫製工序等等事前準備：因為可預期在後期染色會有意料之外的結果，從一開始的設計階段就需要考量到染色時可能的情況，將款式設計成能夠平放的結構；或是在縫製時，需要因應接下來染色過程需求而避免例如膠襯、牽條、重疊過多布料等作法。也因此在服裝結構上受到限制，可能需要不同於一般服裝縫製流程的處理方式。

對比於先預想了成品外觀再反推製作方式，而最終得出接近想像中成品的設計過程，需要處理材料及染色的作品會因為製作方式限制而影響最終設計，在製作過程中也會因為產生變數而僅能作出「盡可能接近預期」的選擇。雖然過去的作品也有許多手工刺繡或細節縫製，但在我的主觀感受裡，越是涉入更多材料開發，而增加流程上變數的同時，「從設計到產出」——這個從思考到執行的結構，會解離成更片段卻相互緊密連結的經驗。同時身為設計者和製作者的我雖然包辦整個過程，但在過去是從設計到打版、進而車縫樣品、檢驗成果並輸出成品：如同分離了我這個人的不同功能，在大量生產流水線的每個勞動工作職種上轉換。然而當變數增加、每個階段都必須做出調整時，我在各個流程中都沒有完整的掌控性，需要隨時和「發揮另外一個功能的我」進行協商。

在我過去的設計教育和產業知識裡，每個服裝製作過程都是切割開的，以方便不同功能的勞動者間能有明確的職掌分野和溝通流向，而這樣的角色分配也造就出了產業裡的階級結構——如設計師／工廠管理者普遍被認為比操作單純步驟的製造工人擁有更多權力。之所以會有這樣的結構模板，是因為現行的成衣工業利用世界上不同地區的勞動條件和人力成本，將服裝製作的過程拆分為每個職位不同的職掌，以方便在生產過程中，以最低的成本生產出最大量的成品。在掌握全球化大眾主流審美的文化輸出國進行設計、土地成本低的地區生產原料、人力成本低的國家進行縫製——這樣的產業結構反映在提供勞動人才的設計教育單位中，就是將整個設計製造流程所需的功能拆散在不同的課堂裡。像我這樣在學校裡認識並學習服裝的人，也就不知不覺地將產業裡現有的生產結構帶入自己的思考方式裡了。確實以商業性考量來說，工作職掌的分割對於效率和人力資源的分配不可或缺，也是在考量任何成品商業化的可能時必須面對的問題；但如果針對設計方法來探討的話，我覺得認知到自身的設計思考被產業結構所制衡這點相當重要。個人認為也是當代設計師在面對產業結構變化時能夠努力的方向和破口。

從二千年初期開始認識服裝設計、進入學校並進而以設計為業，在這段同時也是網路由新興至普及的時間裡，理解到時尚的概念本身也在快速的流變。現今的服裝產業因應當代社會逐漸民主化、分眾化、多元性和對地區性文化越加重視的趨勢而開始有結構性上的改變。在強調奢華和精細工藝堆砌出極具戲劇張力的華服的時代，塑造時尚的核心概念建構於排外和有限制的觸及率；藉由造就神秘感、稀有性和權威性的方式將擁有特定服裝作為彰顯社會階級的符碼。然而在多元文化價值逐漸取代單一故事的趨勢下，大眾更傾向追尋以服裝凸顯個人選擇和族群認同（地域的、文化的或是價值認同的），過去以歐美白人文化為中心的主流審美逐漸被拆分為無數沒有高低之分的多角度敘事；在話語權分散的同時，時尚也逐漸失去其以排外本質造就的稀有性和威權性。

當大眾更希望服裝符碼能彰顯個人思考和價值選擇時，能夠體現出多重故事性或能和個人產生經驗連結的產品比起大量生產的成衣更吸引人。將金錢投資在購買無論是旅遊、學習、感受或人際交流的「經驗」成為新的消費趨勢，服裝價值也逐漸從體現經濟能力、權力掌控轉變為展現獨立思考和與其擁有者間的私密連結。在這樣的趨勢下，手工藝（crafting，同時可以是由工匠實現的作品或如DIY等手工製作的作品）因其生產過程為產品價值的一部分，能夠在經驗體驗上比起消費型產品更為深刻；無論是由親手學習製作的作品、投入時間了解其文化價值的工藝品、或代表特定族群連結的共作成品──將單純的金錢交易行為轉變為體現個人價值觀的消費選擇，能使擁有者和物品間的關係脫離單純的物質佔有層面──對於追求和產品間的情感認同經驗的當代消費者而言也會是更有意義的選擇。

體認到產業正在轉型的徬徨感促使我尋求和服裝的本質更為貼近的途徑和立足點。如同大環境的時尚權力核心由單一軸線轉化為多重敘述而未定型的多層次結構，我也試圖重新審視自身對於服裝設計、對於自己身為服裝設計師這身份的認知框架：在這個生產過度、資訊過量而空虛感滿溢的時代裡，未來的服裝應該要往哪個方向走呢？在創造慾望、刺激消費之外，時尚作為個體間的溝通途徑和映照社會狀態的顯像，能不能在「服裝」這個實質產品外，為人們、歷史或環境創造別的循環？期待能夠看到這些未知逐漸變化，對我而言，就是繼續在這裡的原因。

服裝設計 / 文 陳翊羽

Chen Yiyu, As Fashion Designer

Since the beginning of my exposure to natural dyeing and hand-knitting until my participation in the laser dyeing project, there has been great changes in my design methods and ideas. In the process of performing the dyeing and handling the initial material processing, due to the involvement of more unpredictable factors in these manual processes in comparison to the direct use of mass-produced materials, it is often more difficult to achieve the expected effect in the finished product from the beginning, or it may be difficult to predict the output quality from each stage.

Compared to past design process using familiar materials (industrially produced textiles) and traditional clothing manufacturing techniques, using these natural fibers and a small amount of hand dyeing forces me to adopt a more open design process and to be more tolerant for uncontrollable results. This includes preparations in concept design, pattern-making, and handling of sewing processes, among others. Because of the likelihood that the dyeing will have unexpected results in the later stage, it is necessary to consider the possible circumstances that will appear during dyeing since the beginning of the design stage, and design the style in a structure for it to be able to lay flat. Or when sewing, it is necessary to consider the requirements for the dyeing process in order to avoid practices such as rubber lining, strips stretching, and excessive fabric overlapping, etc. Therefore, the structure of the garment becomes limited or it requires a different treatment method from the general garment sewing process.

In contrast to the design process that first anticipates the appearance of the finished product and then reverses the production method, and then finally comes close to the imagined finished product, the kind of work that needs its materials to be processed and dyed has its final design affected due to the limitation of the production method. During its production, I can only make choices that are "as close to expectations as possible" due to the variables during the production process. Although my past works also involved a good amount of hand embroidery or details to sew, in my subjective experience, the more involvement in the development of materials and the more variables in the process, 'from design to output', the structure from thinking to execution will dissociate into more fragmented but closely connected experiences.

As a designer and producer, although I arranged the whole process, in the past, from design to pattern making, sewing samples, inspecting results up until the output of finished products, it was as though I was separating different functions from myself, own and mass production lines. Each type of job in the mass production line is converted; however, when the variables increase and adjustments must be made at each stage, I do not have complete control in each process, and I need to negotiate with "my other self who plays another function" at any moment.

In my past design education and industrial knowledge, each garment production process is cut to facilitate clear job division and communication flow among workers with different functions. Such role allocation also creates class structure in the industry (such as designers / factory managers are generally considered to have more power than manufacturing workers who operate simple steps). The reason for such a structural template is that the current garment industry uses labor conditions and labor costs in different regions of the world to split the garment production process into different positions in order to achieve the lowest production costs while producing the largest amount of finished products.

Design in a cultural exporting country that masters the mainstream aesthetics of the globalized masses, produce raw materials in areas with low land costs, and sew in countries with low labor costs-such an industrial structure is reflected in the provision of labor talent is designed amidst an education unit, where the functions required for the entire design and manufacturing process are dismantled in different classrooms. People like me who get to know and learn clothing in school will unconsciously bring the existing production structure in the industry into my own way of thinking.

Indeed, in terms of commercial considerations, the division of job functions is indispensable for efficiency and the allocation of human resources. It is also a problem that must be faced when considering the commercialization of any finished product; but if we discuss the design method, I think It is very important to recognize that one's own design thinking is restricted by the industrial fashion structure. Personally, I think it is also the direction and breach that allows contemporary designers to work hard towards to in the face of changes in the industrial structure.

Fashion designer / written by Chen Yiyu

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「如果時間是穿戴且折疊的」是雷射染技計劃和服裝設計師陳羽羽的合作。在此次展覽中展出數件不同款式。這些版型嘗試以適合雷射光染投影範圍的矩型做為版型雛型，並從這些矩形中解構出適合穿戴的服裝材料。

"If Time Was Wearable and Foldable" is a collaboration between the Laser Dye Project and fashion designer Chen Yiyu. Several different styles are showcased in this exhibition. These versions try to use the rectangular shape suitable for the projection range of the laser light as the prototype, and deconstruct the suitable clothing materials from these rectangles.
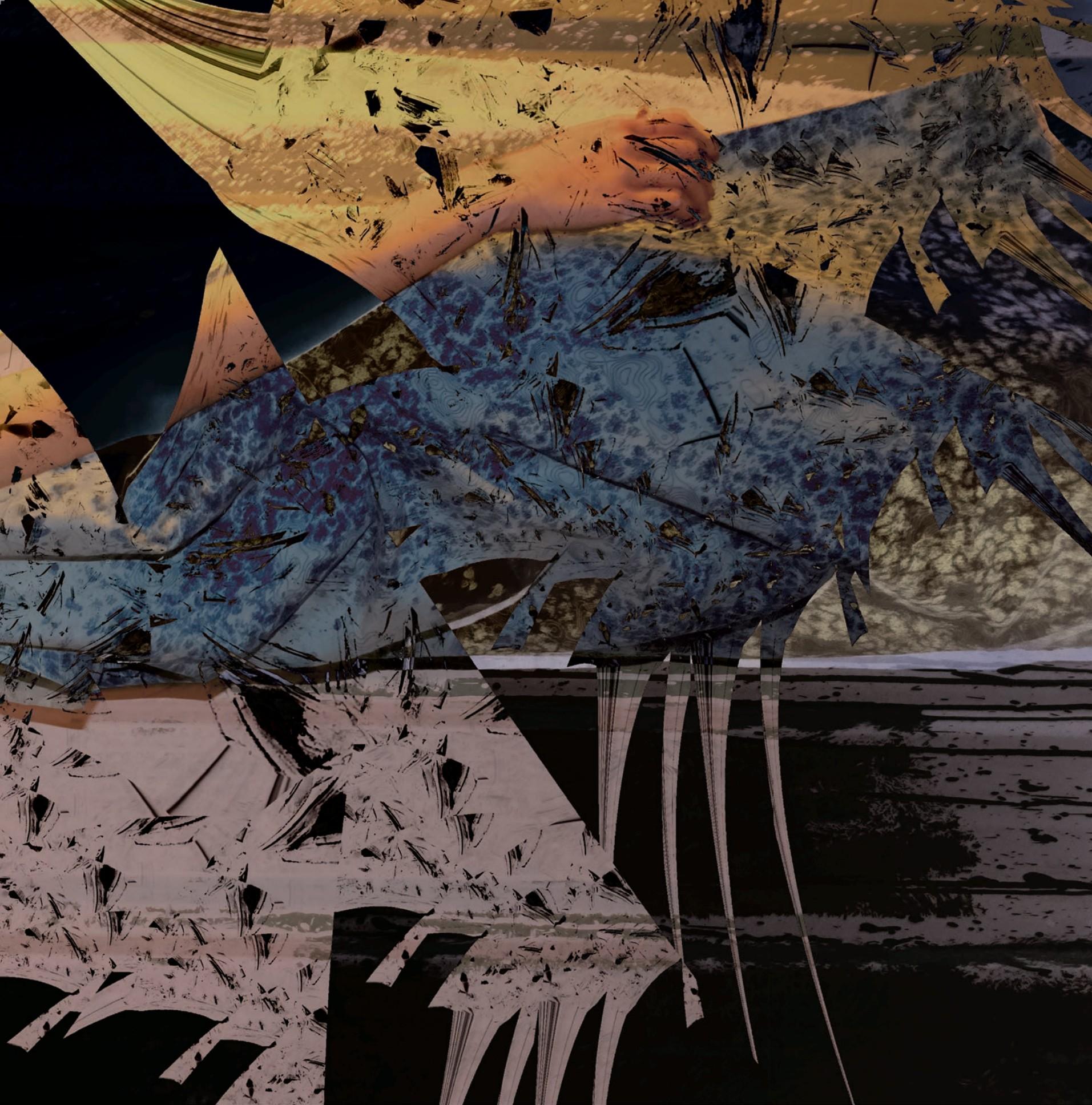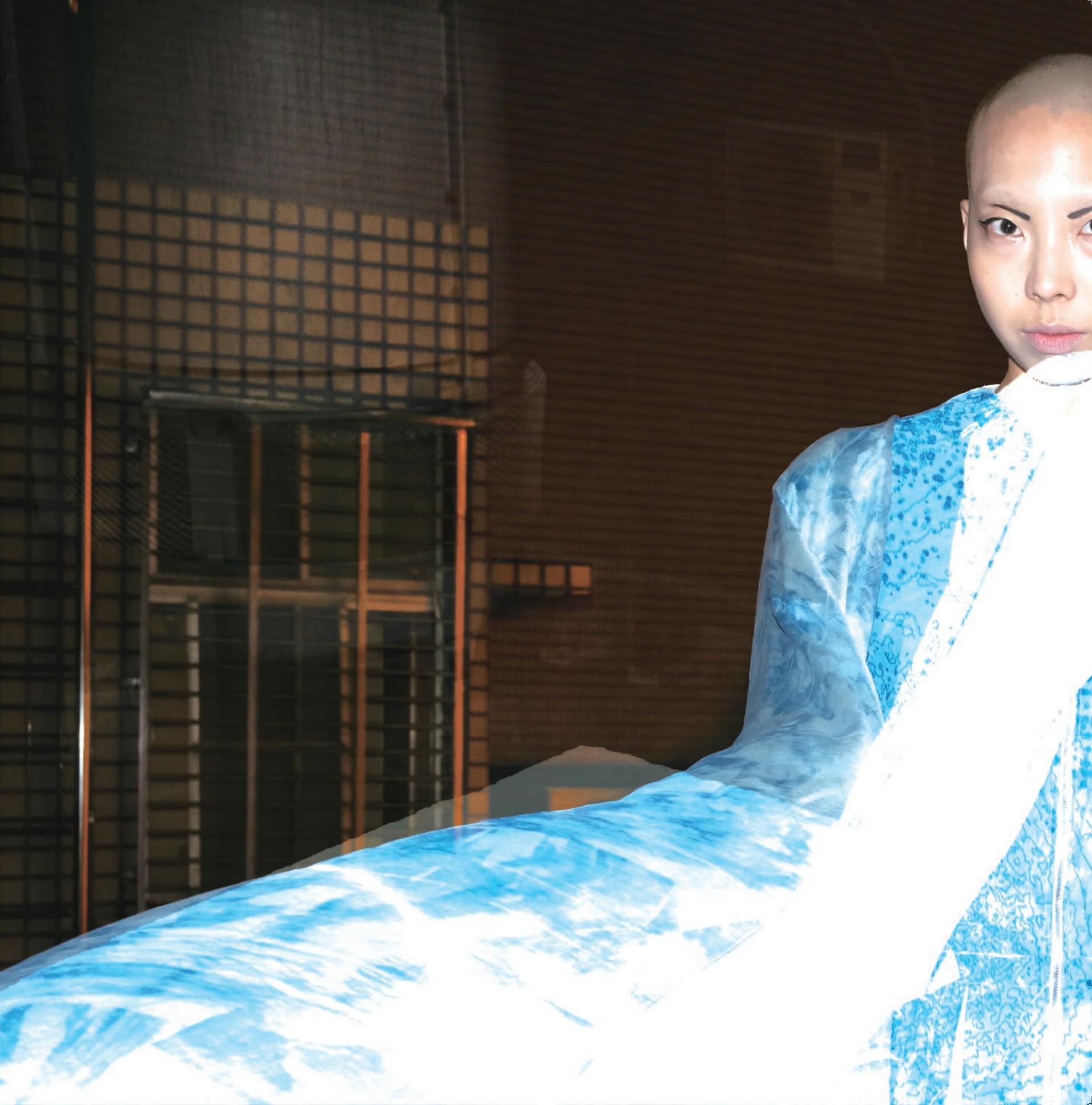
末世＝歿世＝漠視石虎
呂秀娟
棉布、絲、棉線

The Cold Eyes of The Leopard Cat
Lu, Hsiu-Chun
cotton fabric, cotton threads, silk

冷漠的視線所及，表達石虎棲息地被破壞殆盡的無助，結合數位雷射印刷出的若隱若現的清藍與蔭藍襯托出的冷絕。白色線條與華麗的彩色繡線代表著人類的開發與石虎爭地。石虎的數量逐年遞減中，在作品中，石虎堅毅的眼神，並非無助，因為牠已在這美麗的寶島生存了數百萬年，比島上的人類還早定居在這裡，在自己家，牠從不畏懼，但牠不明白的是，牠的家人為什麼會越來越少，近年來，牠的棲地被過度開發，在田野調查結果，全台已剩不到五百隻，作者想藉由作品的張力，喚醒人們對石虎的保育，以及對棲地環境保護的重視，讓這台灣寶島上美麗珍貴的特有物種，不至於走上雲豹被滅絕之路。

IThe coldness reflected by light and dark blue produced by the laser Dye represents the helplessness of leopard cats whose habitats are almost completely wiped out by human beings.
White and colorful threads represent fights between human developers and leopard cats whose number is largely decreasing over the years. However their eyes are still robust; their herd has settled on this beautiful island for millions of years, much earlier than human beings. This is their home; they shall not feel fear. But to their bewilderment, they are still losing family members.

Largely due to destruction of their habitats, the number of leopard cats now is lower than five hundred according to field surveys.
The author attempts to raise people's attention to protection of leopard cats and their habitats through the tenacity of this work and to prevent them from the similar tragic extinction of clouded leopards.

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時間的網

王玉蓮

棉布、棉繩、苧麻布

Web of Time
Wang Yu-Lian

cotton fabric, cotton robe, ramie fabric

天地間的運轉即為時間，這時間像一張無形的網，你我均生活在這時間的網中，每個人對此網的感覺雖不同，或如正六角的規律或如紐曲的線條或如塊狀且深淺各不同，形形色色各自不同，但都在此網中。

所以，我在上方用漸層藍染代表天，下方用水管染代表地，兩者之間用正六角型、粗細線條且不規則多角形、不同色澤的不規則塊狀等交錯混合，代表著時間的網的抽象形態。

The operation of the world is time. Time is like an invisible web, in which we all live. Every of us might feel differently under the web, such as hexagonal, curving or sectarian in various shades. All are diversified in the web.

I use indigo-dyed shades to represent the sky, tube dye to create the earth. In between is the mixture of positive hexagons, lines of various width and several irregular sections with various shades to represent the abstractness of the web of time.

失焦的島嶼
楊偉林
亞麻布、烏干紗、礦物顏料、銀箔、魚線、玻璃珠、大頭針

Defocused Island
Yang Wei-Lin
Linen cloth, organza, mineral pigment, silver foil,
fishing line. glass beads, Pin

用同一座島嶼不同類型的地圖重疊錯置在畫面上；地圖部分用雷射染處理，餘地以柔紙貼銀箔襯托。

是一座想看清楚又無法看清的島嶼，是一座在記憶中虛實交映不能卒睹的島嶼，是一個時間往復的黑洞。

Overlap various sorts of maps of the same island and treat the map itself with Laser Dye while the remaining part pasted with silver foil on a paper base.

An obscure island that tries to make it visible. An island steeped in the memories where reality and imagination overlaps. A black hole through which time traverses.

時之流
莊雅婷
白胚布、椰子纖維、紙藤

Current of time
Zhuang Ya-Tin
cotton cloth, cocona fibre, paper rattan

「時間」對我來說是流動不停止的，從源頭到大海。站在這 條流之中，發現不斷的流逝，許多的記憶、回憶等片段。因 此以河流為發想，呈現過去、現在、未來的時間之流。運用 楊柳絲表現河的流動感，以淺藍染加上點淺咖啡色塊讓 流動中的光影加深;源頭的地方使用包邊布呈現皺折、捲 曲及密度的多寡表示曾經的回憶，可提取或被遺忘的，一 圈、一塊的留在這裡，不同的色塊表示人生不同的經歷愉 悅、悲傷、無助等。左上及右下以不同的媒材椰子纖維及 白紙藤為兩岸突顯河流的意象。雷射圖為茂盛的大樹，在 時之流中象徵人的一生，如花一般的生長。

"Time", for me, constantly flows and never ceases, from the source to the ocean. Standing in the current, I see memories running away through me. Thus inspired by the image of river, I try to present a current of time of past, present and future. The flow is represented with crepon, with shades augmented with light indigo and coffee dyes. The source is created with folds and curls of trims, whose intensity indicates those remembered and forgotten memories left at this point. Various colorful blocks represent experiences of happiness, sadness and helplessness. Upper left and lower right are riversides created with different materials including coconut branches and white paper twines. The laser dyed graph is a vibrant giant tree, representing the life in the current of time.
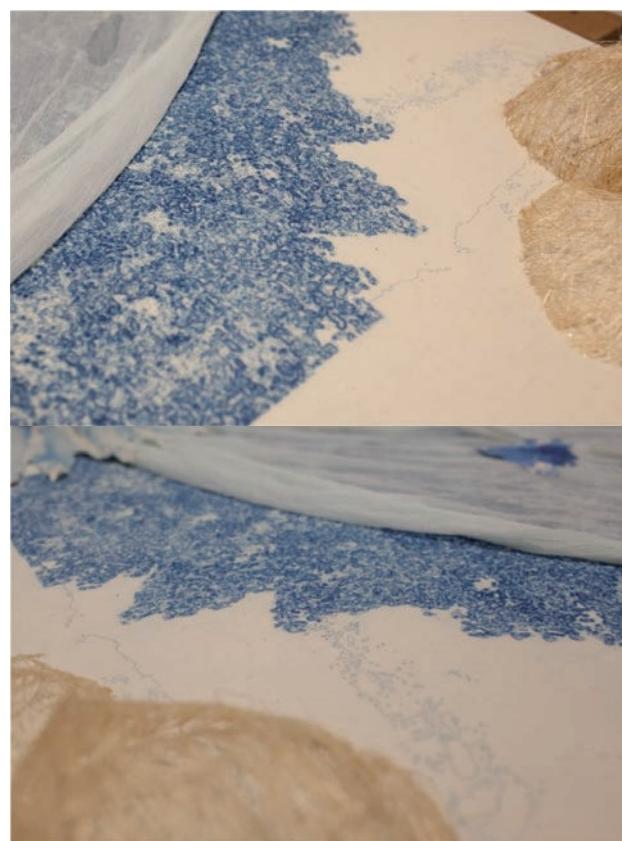
附離

呂淑瓊

棉布、絲、棉線

報紙、鐵絲、珠子、羊毛、棉布、蠶絲布、苎麻布、構樹皮、黃槿

樹皮、絲瓜絡、棉花

Attach, Detach

Lu Shu-Chong

newspaper, iron wire, beads, wool, cotton cloth,

silk cloth, ramie cloth, paper mulberry bark,

linden hibiscus bark, dried loofah

主題「附離」是關於生物成長的紀錄，作品以頭嵙山樹林
為意象，應用抄紙技術，穿透穿透，表現生命的執意前行，
共生共榮，解構與再結構，扭轉，離合，接應，覆蓋，補空，
各自成形，各說各話，自己說自己的故事。

"Attach, Detach" is a growth record of life.
Taking the image of the forest in Mount Touke,
utilizing the traditional papermaking tech-
niques, this work seeks to present the life's
strong will of moving forward. They may grow
and prosper together, construct and deconstruct,
twist and detach, attach and overlap, bridge the
gap, take own forms and speak own stories.

漸變1/2
陳惠菊
棉布、絲

Transformation 1/2
Chen Hui-Chiu
cotton, silk

集結所習得的藍染色階、絞染紋理、蠟染造型、型染
圖案、漸層染色調，輸出為正負片黑白稿圖像，試著
以數位輸出的氰版雷射染色的數據性、科技性對應
藍染的人文性與時間性浸染。將正負片的顯影黑稿
裁剪成小小方舟，以節奏性的圖像灰階從黑色調至
白色調的漸變安排圖檔，用雷射染顯影後再縫製成
一長條型方舟造型，象徵天然纖維染色的新嘗試與
前瞻性。漸變1/2，是5年間接觸植物染色過程的漸
變遊歷。

A collection of past indigo, shibori, batik,
stencil and gradient dye practices is
reproduced into black-and-white positive
and negative images. The artist tries to
contrast the digital nature of the Cyanotype
Laser Dye with the humanistic and
time-consuming nature of indigo dye. The
black-and-white images were cut into small
blocks and rearranged according to their
grayscale. After processed by the Laser
Dye, the final results were sewn together to
form a long boat, representing a novel
experimentation of natural fiber and
natural dye. Trans-formation 1/2 is a
five-year traverse through the field of
natural dye.

如果回憶過去便是穿越時空
鄭宇倫
棉、蠶絲、尼龍

Recalling The Past as If Time Travels
Cheng Yu-Lun
cotton, silk, nylon

時間給我什麼感受? 在回憶時我可以感受到深刻的時間性，在回憶中我感受到時間給我的虛實錯置。回憶過往的時候，現實世界的真實性會如同一張紙被燒破一個洞，我們可以透過這個洞看到過去。於此同時我們便並行在過去的時空中。

How does time feel for me? When I remember, I can feel the profound timeliness. In the memories, I can feel the misplacement between time and reality. When we recall the past, the authenticity of the real world will be like a piece of paper burned through a hole, and we can see the past through this hole. At the same time, we are walking in the past.

山行
陳思睿
舊制服

Mountain walk
Chen Szu-Rei
old uniform

光年為一種距離單位，即光行走一年的距離。以時間作為一種測量空間的方法，而光會透過折射、繞射來改變前進方向，而我在雷射染中想要去實驗光去投射在崎嶇不平的物件上產生的變形圖案。

旋轉、縮放、扭曲和透視都是使物件變形的方式，如果記憶對於人而言也是一種可存取與編輯的檔案，那這些被裁成新的布塊們即是一種另存新檔。我擷取於服役待在山中的日子，那些每天繞行著山林，看著山的曲面與太陽照射在山谷中形成的漸層與塊面的顏色；以制服舊衣作為載體，將行徑的路線輻射在時而隆起，時而下沈癱軟的山丘之間。記憶與情感也是同樣的投射在大腦的皺摺內儲存著，有的印象模糊而不清，有的雖已久遠卻歷歷在目，像是雷射光染色於制服的身上，時而顯影，時而消褪。

Light year is a unit of distance measurement, literally the distance for the light to travel for a year. A method to measure space with time while the light would change directions through reflection and diffraction. I tried to experiment distortion when the light is projected onto uneven objects through the Laser Dye. Revolving, zooming, twisting and perspective are different methods to distort an object. If memories are like files to be read and edited at will by human beings, those newly cut fabric pieces represent another 'save as'. Taking my military service experiences in the mountains as inspiration. I walked around them, looking at their curvy surfaces as well as blocks and shades created by the Sunon the valleys.

Thus I chose the old uniform as the medium for projecting my walk route on the ups and downs of fabric folds. Memories and emotions are projected on the cerebral folds in a similar way. Some obscure, others still vivid after long years. Just like the Laser Dye on the uniform; some visible, others fading.

遊走

楊雁如

棉布、楊柳蠶絲、木

Wandering

Yang Yen-Ru

cotton grepon, silk, wood frame

對運用雷射光染色過程的控制與變因產生興趣，在測量
準備、人為操控及運用科技設備的標準過程之下，存在
有自然環境變因或是人為誤差變因介入，進而產生與預
期相符或者不符的效果。將此種實驗性濃厚的狀態，連
結至人工飼養錦鯉，培育身上花紋的育種狀態。此作品
以鯉魚造型、圓形細胞、卵、DNA圖樣為敘事媒介，套入
此雷射光染色之不確定性的運作情境，如同在具一定程
度控制下的育種(挑選種苗、溫度、水質、飼料等)，最後
身上所產生花紋是一種可預期和不可預期之控制與變
因交織下的成果。

I am interested in the controlled and dependent
variables of the Laser Dye process. Under the
standard process of measure and preparation,
human control and technological equipments,
natural environmental variables and human
intervention may still result in expected or
unexpected outcomes. I relate this experimen-
tal process to captive colored carps breeding for
their body forms and colors. Using the form of
colored carps, their round cells, eggs and DNA
pattern as the narrative media, applied with the
uncertainty of the Laser Dye, this work presents
a final pattern born out of the interaction of
expected and unexpected controlled and
dependent variables, under a certain degree of
control, similar to the fish breeding program
(selection, temperature, water quality and
feeds).
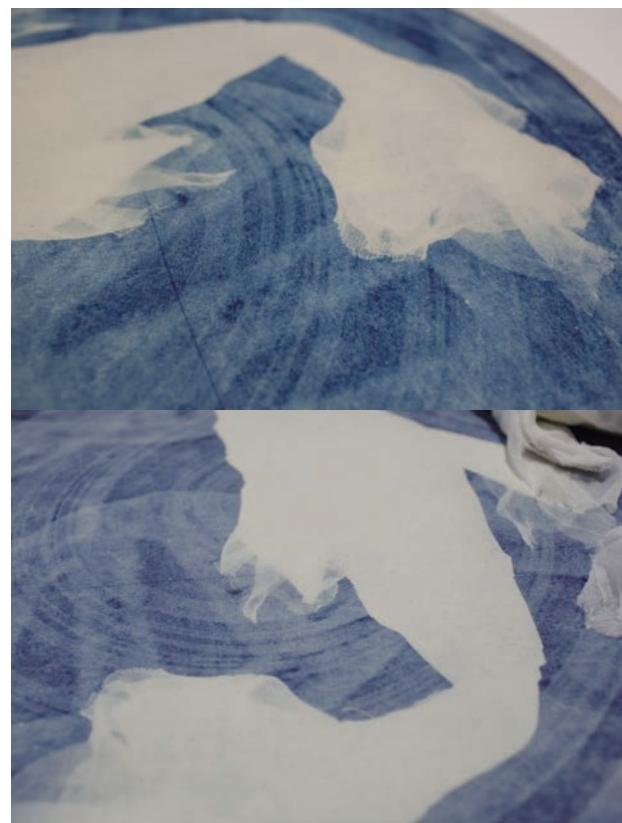
和記憶中的味道交 (蕉)會
許仙霖

棉布、棉線、藍染

Meeting Bananas in The Memory
Hsu Xian-Lin

cotton cloth, thread, indigo dye

臺灣地處熱帶，香蕉在日本殖民時代，經過多次改良，從1902年開始成為外銷產品，也在日本本土大受好評。直到1963年日本香蕉進口自由化後，台蕉順利銷往日本，銷售量暴增，打下日本9成市場，1967年極盛時期，年出口2700萬箱香蕉，賺取外匯6200萬美元，佔當時臺灣外匯1/3。高雄港香蕉碼頭堆滿準備外銷的香蕉，當時公務員薪水每月500-750元，但農民一年收入可達20萬元，換算今日可說是千萬年薪。

1969年3月發生剝蕉案，正值當年台日香蕉談判期間，結果一片大亂下，香蕉價格被大砍，出口量也被削減，而在台日香蕉貿易惡化時，部分日商轉而採購中南美與菲律賓香蕉，導致臺灣香蕉出口量崩跌，數年內只剩1/4，香蕉王國一夕崩解。
南投也曾是山蕉的故鄉，天皇蕉的盛名，也道盡了過去盛極一時的產業情況，染滿香蕉汁的被單，是一幅幅香蕉的故事，是輝煌歷史，也是辛酸的血汗，在時間的循環中，是否可以再出現另一段金蕉歲月？

Located in the tropical area, Taiwan's banana begun exportation under the Japanese colonial government in 1902 and earned great acclaims in Japan.
In 1963, Japan opened its banana market. The exportation of Taiwanese banana thus largely increased and accounted for 90% of the Japanese market. At the peak year in 1967, the annual export of 27 million boxes net in 62 million US dollars that accounted for one-third of Taiwan's annual foreign exchange at the time.

At the time Kaohsiung harbor was decked with boxes of banana waiting to ship out. The average monthly salary of public servants was around five to seven hundred fifty Taiwanese dollars, but the annual income of banana farmers could amount to two hundred thousand, equal to today's millionaire.
However, the political oppression against the farmer's union took place in the midst of the Banana exportation negotiation between Taiwan and Japan. In the chaotic aftermath, the price and the volume were hacked.
While Taiwan-Japan trade deteriorated, part of Japanese importers turned to Latin American and Pilipino exporters that resulted in the landslide collapse of Taiwan export. The annual volume cut down to one-fourth in few years and Taiwan lost her title as the Kingdom of Banana. Nantou used to be the homeland of mountain banana; the famous Emperor's Banana attests to its past prosperity. Linen sheets dyed in banana juices speak about the story of Taiwan's banana. Past glories, labor of sweats. Would we see another golden period of banana when time revolves?

顛簸的線

沈祐誠

棉布、3D列印

Uneven Lines

Sheng Yu-Chen

cotton cloth, 3D printing

回應展覽主題「時間」，以作品記錄雷射染的過程為題創作。雷射染與印刷最大的不同在於上色的過程可以在立體的物件上完成製程。擷取代表纖維的線性圖案，並在製程中使天然棉布依附在顛簸塊體上，使雷射染的過程記錄下顛簸塊體的痕跡，最後以平整的面展示過程留下的痕跡。

In response to the exhibition theme-"Time", this work was created to record the process of the Laser Dye. The major distinction between the Laser Dye and printing is that the former could be applied on three-dimensional objects. Taking linear patterns that represent fiber, attaching the natural cotton cloth on rolling objects, the resulted work displays the traces and marks left by the rolling objects through the Laser Dye.
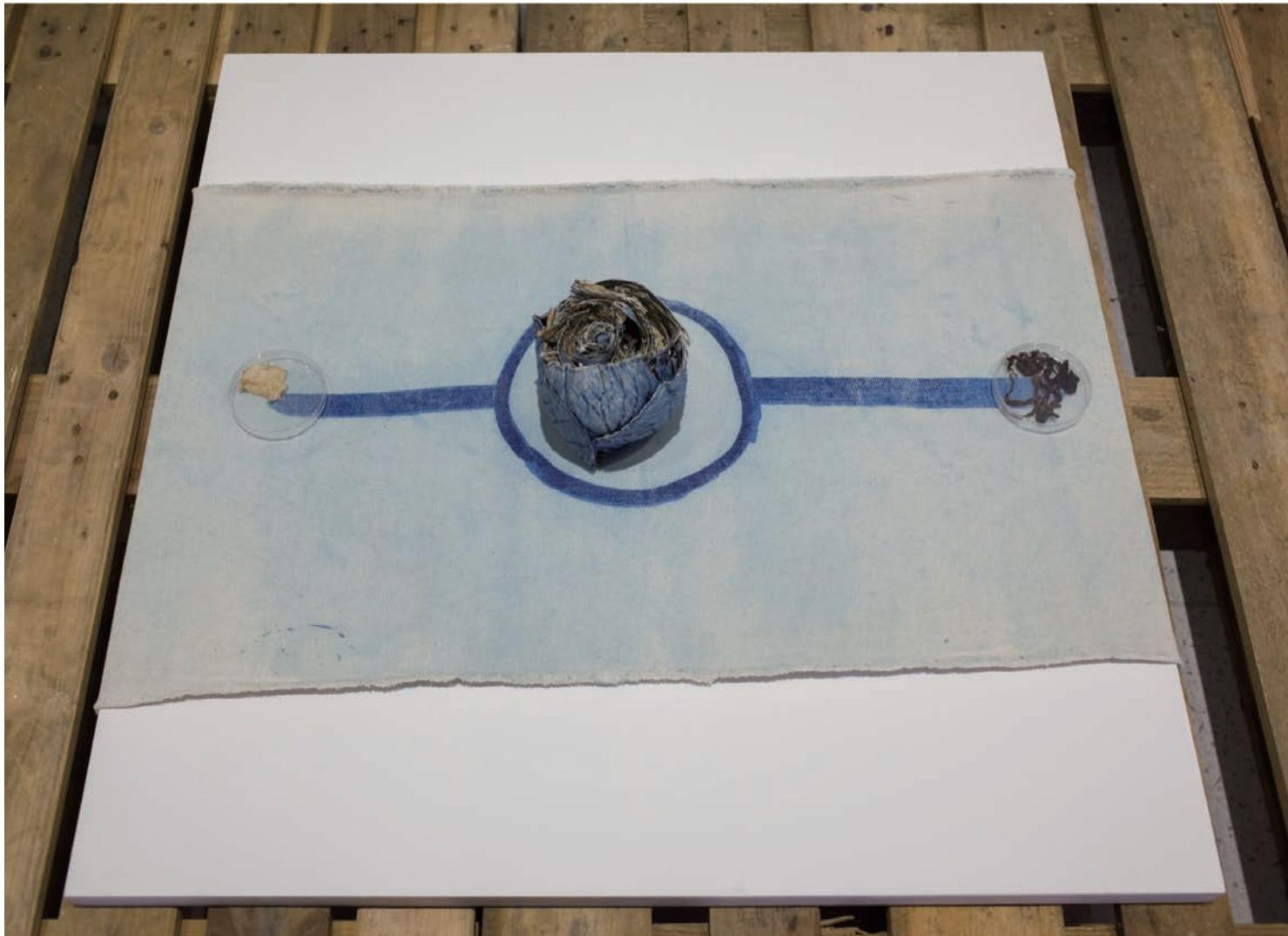
發酵
黃喆梵
構樹皮、高麗菜乾、高麗泡菜乾、棉布

Fermentation
Huang Shih-Fan
paper mulberry bark, dried cabbage, pickled
cabbage, cotton cloth

時間對於發酵是一種重要的調味料，使用台灣高山高麗菜藉由不同的發酵方式，延伸出高麗泡菜和高麗菜乾，從時間最短的高麗泡菜，簡單的水、鹽和高麗菜，浸泡三個禮拜左右存放在冰箱就完成了。到高麗菜乾藉由曝曬乾燥，延伸出一個沒有所謂的最佳賞味期限，只有放越久顏色會變越深，味道也更濃郁、更有深度。味道從原本的甜味轉換成酸味，人類只是藉由大自然的力量從旁幫助微生物、酵母菌好好的自然發酵來轉換風味。藉由發酵來學習生活，也是我現在一直身體力行的，在這個過程中對於季節變化、關心環境來深入在地人文文化。

Time is an important condiment to fermentation. Different fermentation methods transform Taiwanese cabbage into different foods: pickled and dried cabbage. Adding water and salt, pickled cabbage would be ready after storing in the refrigerator for three weeks. Dried cabbage is transformed by sunlight and has no specific best before dat. The longer it is dried, the darker, stronger and tastier. The cabbage would turn to sour from sweet in flavor. We human beings rely on the natural forces, such as microorganism and yeast, to transform flavors. Now I am living my life learning from fermentation and getting close to the local culture through seasonal changes and environmental concerns in the process.
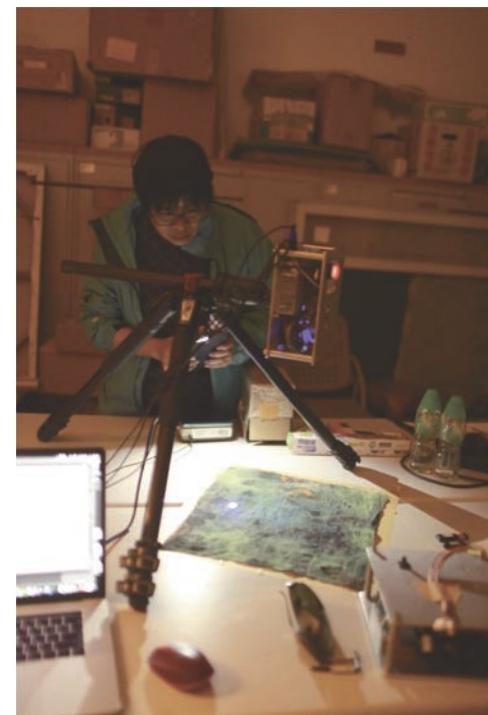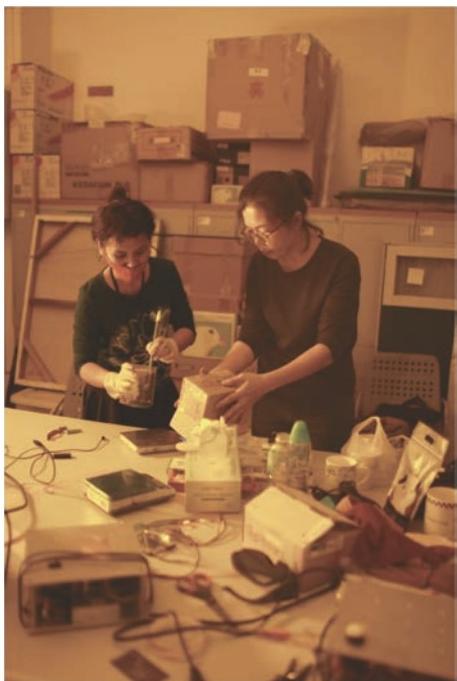
以「無邊」為題的演說
ISC/Toru & Ilda Performative Borderless ISC Lecture and Dialogue

ISC是一個正在進行的項目，由金·伊爾達，曾受過視覺設計和媒體藝術方面教育內容的專案管理師和攝影師，以及與藥劑師和雕塑藝術家大山龍，一起在德國發起的合作計劃。計劃的媒介是兩人彼此之間對於他們感興趣的議題以及觀點所發起的定期對話討論，有時這些對話甚至產生了實體作品。實質和抽象；有形的和無形的；以及那些可見的和看不見的，被吸引到相反的極端，並以不同的視角重新定義「新」的含義。自2009年11月起，該合作計劃被稱為ISC（Idea Section Card），並一直活躍在德國。ISC的最終動機是，對於今天或將來是否可能發生的事情，實際可以實現和維持的事物永無止境地產生疑問是我們想像力的唯一結論。基於「對話」這個工作方法，在講座中ISC以「無邊界的營所」為發想主題，試圖和觀眾進行一場表演式的對談。

The ISC is an ongoing project that inititated in Germany through the collaboration of Kim Ilda, a content planner and photographer educated in visual design and media art and a pharmacist Oyama Toru (Ryu) with academics in pharmaceutics and sculpture. The medium of expression is based on art that goes beyond the academics earned in Korea, Japan and Germany with interests in new and different perspectives, leading to dialogue and at times production. Material and abstract; tangible and intangible; and those that are seen and unseen – being drawn to the opposite extremes and redefining the meaning of "new" with a different perspective. Known as the ISC (Idea Section Card), the project team has been active Germany since November 2009. The ultimate motivation behind the ISC is the never-ending inquisitiveness on what can actually be materialized and sustained from the impossibilities of today or if the material product is the only conclusion to our imagination. Based on this working method, ISC interacted with the audience on the theme of "Borderless Camp" in this lecture.

大山龍在講座中簡單的介紹了即將和Hackteria在日本沖繩合作舉辦的跨學科工作營活動。這些持續不間斷地國際合作，成為了盛裝科學藝術內容的器皿，並持續為潛在的未來合作提供內容。

Ryu Oyama also briefly introduced the upcoming collaborative "camp" co-organized with Hackteria during his talk: Gathering for people working interdisciplinary. These uninterrupted international cooperation has become a vessel for art and science, and continue to provide content for potential future collaboration.

在ISC的表演式的講座中，大山龍以自己在日本各地藥局工作的旅居經驗開場，並招待觀眾以日本不同地方的水、植物、土壤中提取出來的合成食物。

During the performative talk given by ISC, Ryu Oyama started with his nomadic experience of working in various pharmacies in japan. He served audience with synthetic food extracted from water, plants and soil in different parts of Japan.

講座：改變工藝社區—維多利亞

# Changing Craft Communities, Talk by Victoria Manganiello

政治和物質的邊界定義了我們的位置。從歷史上看，政治邊界和物質邊界是一致的，因為：誰想穿越整個山脈來挑戰另一側的國家？來自不同文化背景的人們並不經常見面，他們的紡織傳統是完全根據自己的經驗，故事和材料而發展的。他們的位置直接決定了他們的製作方式。最終的技術變革意味著我們不再受限於實際位置。如今，數以百萬計的人在共享的位置（互聯網）上共享技能，技術和故事。我想問，能透過網路訪問任何人的今天，織品文化將如何改變？這個新的教育平台如何改變了誰是老師，誰是學生、什麼是學科？本講座探討了手工藝社區的位置如何從多個、本地的、孤立的，轉變為單一的、在線上的和沒有限制的。我建議互聯網就像建築物或森林一樣，它改變了我們教授，學習，使用和分享紡織技術的方式。當然，這就是讓我訪問台灣並就我們共同的技能和興趣進行這次演講的原因。我將著眼在過去到現在，技能、工具和圖案傳播的方式，特別關注線上工藝社區（如Ravelry，Weavolution甚至YouTube）的現象學演變。我將對未來可能發生的情況做出明智的推測，並特別關注「技巧主義」和國際女性賦權的最新趨勢。

Borders, both political and physical, define where we are. Historically, political borders and physical ones were aligned because: who wants to traverse an entire mountain range to challenge a nation on the opposite side? People from different cultures didn't often meet and their textile traditions evolved informed exclusively by their own experiences, stories and materials. What and how they made was directly informed by their location. Eventual transformations in technology meant we were no longer constrained by our physical locations. Today, millions of people share their skills, techniques and stories in their shared location: the Internet. I ask, how can access to anyone (with a computer with internet) change textiles? How has this new educational platform changed who is the teacher, who is the student and what is the subject? This talk examines how the location of craft communities has shifted from multiple, local and isolated to singular, online and limitless. I suggest that the internet is a location just like a building or a forest and it has changed the way we teach, learn, use and share textile making techniques. It is, of course, what has allowed me to visit Taiwan and conduct this talk about our shared skills and interests. I will look to ways that we have disseminated skills, tools and patterns historically and presently with particular focus on the phenomenological evolution of online craft communities like Ravelry, Weavolution, and even YouTube. I will make informed speculations on what might be possible for that of the future with specific attention to recent trends in "craftivism" and international female empowerment.

維多利亞主持的數據編織工作坊：這個工作坊歡迎專業的編織者或初學者。您將學習如何使用一個簡單的短語，並使用國際轉換法將0和1轉換為二進制代碼。使用基礎的編織知識，您就可以將數據轉換為布料。

Weaving Data Workshop host by Victoria Manganiello: This workshop welcomes expert weavers and beginners alike. You'll learn how to take a simple phrase and turn it binary code using the international conventions of 0s and 1s. Using weaving basics, you translate your data into cloth.
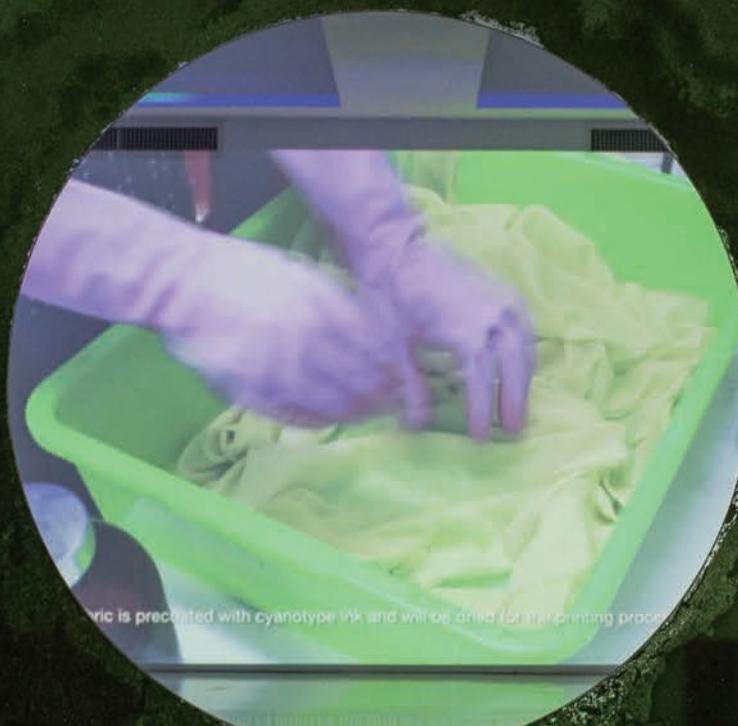
量子的編織測光計
The Woven Actinometer for Quantum

考古學家齊格弗里德齊林斯基將「想像的媒體」區分
為三類，第一類是「不合時宜的媒體/裝置/機器」，指的
是被設計得太早或太遲的媒體，但終在某一時間點上
已然實現;第二類是「構思中的媒體/裝置/機器」，只存
於構想之中從未真正付諸實現的媒體;第三類「不可能
的媒體/裝置/機器」是指不能夠實現的媒體機器，卻
對我們的思維有重要影響。

Archeologist Siegfried Zielinski distinguishes
"imagined media" into three categories. The
first category is "untimely media", which
refers to being designed. Media that is too
early or too late, but it has been realized at a
certain point in time; the second category is
"conceptual media", which is only in the con-
cept and has never really been put into prac-
tice Realized media; the third is "impossible
media" refers to media equipment that cannot
be realized, but it has an important impact on
our thinking.

一個科幻的未來機器

草酸鐵鉀是一個古老化學測光計（actinometer）的主要成份，這個測光計同樣也是氰版發明者約翰・赫歇爾在1825年的發明，他創造了「actinometer」這個詞，其字根actino在拉丁文中指的是光束的意思，具體的應用曾有科學家利用結合測光計和氣壓計的方式，推算出在紅光下，植物透過光合作用將光量子轉換成氧分子的具體數量。

在製造新氰版感光液的過程裡，從冷卻加熱過後的鐵氰化鉀和草酸鐵銨混合液過程中，析出了許多帶有美麗翠綠色的草酸鐵鉀晶體，這些晶體並不被使用在實驗中的新氰版顯影中。雖然此晶體可以再透過混合醋酸和鐵氰化鉀再被使用來製造普魯士藍，但因為其相對容易製造和塑形的特性，所以有了收集實驗剩餘的草酸鐵鉀結晶來製作這此展覽中的水晶圓盤裝置的想法。草酸鐵鉀晶體可以被重複的丟入下次製備的鐵氰化鉀和草酸鐵銨的加熱混合液中，使晶體體積繼續增長，完成的晶體也可以用接近沸騰的蒸餾水溶解，然後透過冷卻並重新結晶化。在這件展品製作過程中我們將玻璃圓盤的週邊以膠帶封住，再注入製作過程中尚未冷卻的感光液，使其在玻璃上冷卻並析出草酸鐵鉀晶體，待晶體和玻璃牢固的結合後，再將圓盤立起。晶體在冷卻中結晶化的時間約24小時，冷卻時間與晶體的物理形狀有關，降溫時間越久所結成的晶體越大。

一篇在OATAO開源論文網站上的論文顯示，在當代一些關於改良偵測光子數量技術的研究，仍然涉及利用這種早期草酸鐵鉀測光計的原理，且這些研究是在微米尺寸下進行的而不是奈米，這意味著DIY技術涉入的可能性。這些微米結構在流體動力學上的設計使用了被注入草酸鐵鉀溶液的撓曲微米小管，並將其曝照在紫外線下，透過量測小管內草酸鐵鉀溶液濃度的變化，便能精準量測這些微米小管所偵測到的光子數量。這篇研究報告的迷人之處在於，類似編織的技巧被利用在微米科學研究中，是為了增加補捉光子的準確度，以增進學術上科學家對於量子產率的了解。這已足夠使人連想到一個科幻的工藝裝置，以及一個工藝社群和量子科學、材料研究之間的潛在連結。

工藝和科學的合作對我們從來都不是陌生的，著名的約瑟夫・瑪麗・雅卡爾（Joseph Marie Charles）所設計的提花織機，其自動系統利用紋紙上的孔洞排列來控制提花織機的機械運動，促進了人類史上第一台電腦的發明。阿波羅十一號登月時所使用的磁心線記憶體（core rope memory）利用編織的技巧和磁氣的原理，設計出人類登月艙上的第一代記憶體系統。這些曾經是高科技的古老媒體都展示了科技和工藝的連結，並曾經巨大的改變了我們的生活。轉身回顧這些歷史，並理解這些媒體如何的曾經或即將形塑我們的世界，隨著進入由技術和物質所開創的人類世的尾聲，站在「古典現代」巔峰的我們，又如何藉由重新省視過去以重塑我們的未來？

在e-Textile Summer Camp的內部發表會上,「羊毛朋克」小組正在示範他們啟發自磁心線紀憶體的作品,在一件夾克的背後置入了一個用導電羊毛製成的八位元矩陣記憶體。
During the e-Textile Summer Camp, the "Wool Punk" group was presenting a work inspired by the core rope memory: an 8-bits memory prototype made of conductive wool at the back of a jacket .

藝術家維多利亞和設計師朱利安的作品:Computer 1.0,向電腦發展的歷史致敬;在被編織的透明的小管內充滿了被微電腦控制流動的墨水流體。
COMPUTER 1.0 seeks to pay homage to the forebears of computer history. Works by Artist Victoria Manganiello and designer Julian Goldman, a handwoven cloth, with a programmed kinetic surface that brings to mind data, code, and communication infrastructure.

A Futuristic Imaginary Machine

Potassium ferrioxalate is the main chemical component of an old chemical photometer called "actinometer". This photometer was invented in 1825 by the inventor of cyanotype, John Herschel. The prefix "actin" in Latin means "ray", and the actinometer is the first scientific instrument named with this prefix. One of many applications of actinometer, in combination with a barometer, is to calculate the amount of photons that plants convert into oxygen molecules through photosynthesis under a red light.

In the process of preparing the New Cyanotype solution, many crystals of potassium ferrioxalate with beautiful emerald green color were formed as a byproduct, which were not used in the exposure process at first. Although the crystals can be reused to make Prussian blue by mixing acetic acid and potassium ferricyanide afterwards. Because of its easy production and molding characteristics, the idea of building an installation made of this crystal for this exhibition emerged. The potassium ferrioxalate crystals can be repeatedly recrystallized with the new sensitizer making process. They can also be dissolved in distilled water with ~100°C and be put into any shape of glass for molding. We taped the periphery of the glass disc and placed it flat, poured the hot New Cyanotype sensitizer inside it in a dark place for the crystallization, and then erected the disc vertically after 48 hours to make sure that the crystals would bond to the glass surface perfectly. The cooling duration affects the physical shape of the crystal, the longer the cooling time is, the larger the crystal becomes.

A paper from 2014 found on OATAO, an open access repository, indicates that in some contemporary researches about improving microreactor technology for detecting photon flux (how many photos are initially from the light source) still involves the principle of this ancient actinometer and the potassium ferrioxalate solution. These studies are conducted in the micron scale rather than nano scale, which suggests the possibility of DIY at home. Next is the hydrodynamic design of these microreactors; the potassium ferrioxalate solution is injected into a winding micro-tubes and exposed under ultraviolet rays, and by measuring the change in the concentration of the solution, the photon flux captured by these micro-tubes can be accurately calculated.
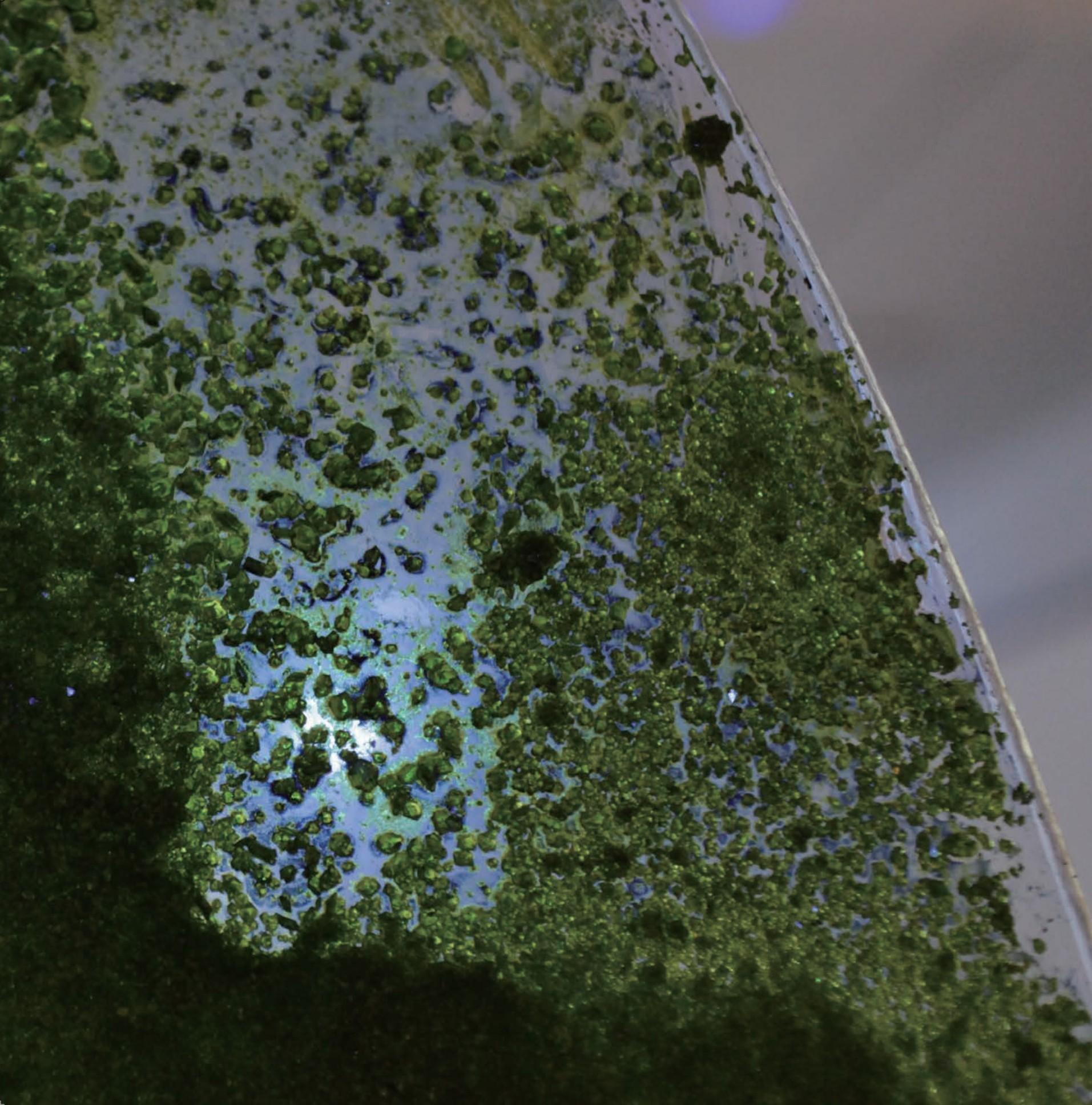
What is fascinating is that the weaving-like techniques are employed in this micron scientific research. Since the microreactors are being made for the purpose to improve academic scientists' understanding of quantum yield, this creates an imagination of a fictional craft, a link between the craftsmanship community and quantum science.

The collaboration between craftsmanship and science was never strange to us. Joseph Marie Charles invented an automatic system that uses punch card to control the mechanical movement of a jacquard loom to weave complex textile patterns. This invention facilitated the invention of the first computer in human history. The core rope memory used in Apollo 11 project employed the principle of combining weaving and magnetism, and it became the first generation memory system. Both of these inventions have changed our lives tremendously. Looking back to these history and realizing how our world is built by these technologies, as we are entering the end of an anthropocentric era while standing at the pinnacle of "classical modernity", what more could we do to invent our future by altering our review of the past?
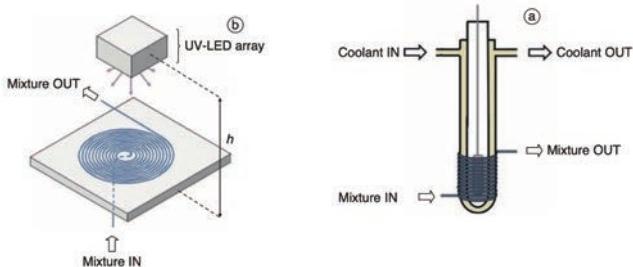
用以校正光子通量測量的微米光反應器模型構造圖，該裝置被描述於論文「用測光計精確測量兩個連續流體式微米光反應器內接收的光子通量」。
The illustration of the micro photoreactors which is used for calibrating the measurement of photon flux. This device is documented in the paper "Accurate Measurement of the Photon Flux Received Inside Two Continuous Flow Microphotoreactors by Actinometry"